ABERDEEN

COMPLETE NETWORK SOLUTIONS

USER'S MANUAL

AberNas 106

AberNas 110

AberNas 116

AberNas 221

AberNas 231

AberNas 232

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INTRODUCTION

Aberdeen LLC, the Custom Server Solution Provider, has provided an excellent selection of quality custom computing solutions to the IT professional for more than a decade. As an innovator of storage solutions Aberdeen has become a one-stop solution source for the IT Professional.

The computer industry is a continuously evolving marketplace. With a clear vision of the future, Aberdeen has become a trend setter via its vast technical experience and industry foresight. Aberdeen is a pioneer in providing customizable rack mounted servers, backup solutions and scalable NAS storage appliances.

Aberdeen Rackmount Storage Server applicable models.

- Aberdeen AberNAS 106 - 1U NAS Appliance
- Aberdeen AberNAS 110 - 1U NAS Appliance
- Aberdeen AberNAS 231 - 2U NAS Appliance
- Aberdeen XDAS – Scalable Storage and NAS

As an industry leader, Aberdeen not only reduces cost of ownership by offering the longest warranty in the industry, but also has demonstrated better performance and has proven to provide a better ROI than the competition in head-to-head comparisons

ABERDEEN CONTACT INFORMATION

Aberdeen understands that service does not stop once a product ships. We sincerely hope there will never be a situation in which a problem arises; however, should there be a need for service, Aberdeen will be there to provide the prompt, courteous, and efficient service expected.

Headquarters

Address:	9130 Norwalk Blvd. Santa Fe Springs, California 90670
Telephone:	562-699-6998
Fax:	562-695-5570
Email:	GenSales@aberdeeninc.com
WWW:	www.Aberdeeninc.com

Customer Support

Hours:	Monday - Friday, 8am – 5pm PST
Telephone:	562-699-6998 ext. 152
Email:	CustomerService@aberdeeninc.com

Technical Support / RMA

Hours:	Monday - Friday, 8am – 5pm PST
Telephone:	562-699-6998 ext. 326
Email:	RMATech@aberdeeninc.com

5-YEAR WARRANTY TERMS AND CONDITIONS

Aberdeen provides an industry leading 5-Year Warranty on any of its fully configured rackmount servers. All Aberdeen fully configured rackmount solutions are warranted to be free of defects in materials for a period of five years from date of shipment or the lifetime of the product to be free of workmanship defects. A fully configured rackmount system is defined as a system, which in a single purchase includes the rackmount chassis, motherboard, processor(s) with appropriate cooling equipment, memory and hard disk drive(s) all assembled. This warranty does not cover any abuse, misuse or modification of products. We reserve the right to repair or replace the defective product under warranty as we see appropriate. We do not warrant uninterrupted or error-free operation of a product. We do not warrant that any product that you acquire will meet your individual requirements

"Aberdeen's warranty is 'REAL' and their response is immediate!"
- Customer testimonial; Mr. Tawfik Daoud, Maximus Inc.

MISSION STATEMENT

The Straight Talk People. - The primary business focus for Aberdeen is to be the IT professional's preeminent resource for complete network solutions, while remaining dedicated to building and maintaining excellent service and support relationships with its clientele.

COMPANY BACKGROUND

Founded in 1991, Aberdeen LLC is a leading direct marketer of rackmount servers, storage solutions, computers and computer hardware. Voted among The Direct 100 vendors by PC Computing magazine, Aberdeen designs, manufactures and customizes award-winning Aberdeen brand computer systems, Stirling rackmount servers, AberNAS storage appliances and backup storage servers. Aberdeen LLC provides assistance to its vast customer base in the planning, budgeting and implementation of complete network solutions including High-Performance Computing and NAS/SAN deployment within existing IT environments. For product sales, service or company information, contact Aberdeen at 800-552-6868, by fax at 562-695-5570 or visit www.aberdeeninc.com.

GOALS

To provide rack mounted server, data storage, and network solutions to the business, government, education and telecommunication sectors.

To continually offer a comprehensive selection of cutting-edge computer hardware components and be the single source for the most reliable and the best valued backend server networking solutions in the market.

To exceed its clients' expectations through dedicated one-on-one service, unequalled attention to detail, and custom solutions designed to overcome networking obstacles.

THE ABERDEEN ADVANTAGE

Aberdeen's consummate professional and highly experienced sales, management and technical teams are key elements in its ability to provide the finest complete network solutions and service available in the marketplace.

With unparalleled experience in the industry, Aberdeen has accumulated the expertise to design and custom configure any network ranging from a couple of workstations to a complete SAN/NAS network environment.

Aberdeen's ability to provide the best service and hardware availability is enhanced by its certifications and partnerships with the recognized leaders in the computer industry.

Company Certifications include:
- Microsoft Certified Partner
- Intel Premier Provider

Staff certifications and qualifications:
- Microsoft Certified Professional
- Microsoft Certified Systems Engineer
- Intel Certified Solution Consultant
- Intel Certified Integration Specialist
- Novell Unix and Linux Professionals

ABERDEEN LEADS INDUSTRY WITH 5-YEAR WARRANTY

Aberdeen is pleased to provide an industry leading 5-Year Warranty on any of its fully configured rackmount servers. Whether you select one of the pre-configured Stirling servers or custom design a complete server for yourself, it will be warranted to be free of defects in materials for a period of five years from the date of shipment and for the lifetime of the product to be free of workmanship defects.

CUSTOM SERVER SOLUTIONS PROVIDER

Aberdeen LLC has provided personal and corporate customers quality custom computing solutions for more than a decade. Customizable Stirling rack mounted servers, backup solutions and AberNAS storage appliances not only offer a longer warranty and demonstrate better performance, but have proven to provide a better ROI than the competition in head-to-head comparisons. Aberdeen offers a comprehensive product line for the Gaming Enthusiast to the IT Professional.

- Fully Customizable Rackmounts, Servers, Chassis and Systems
- Full Network Solutions and Rackmount Server Cabinet Models
- NAS/SAN Mass Storage Solutions Units and Appliances
- RAID protected Disaster Recovery and Backup Servers
- Governmental, Educational and Corporate Workstations
- Complete Server Solutions for Microsoft, Unix and Linux platforms
- Industrial PC Components; Data Acquisition, SBCs and Backplanes
- Hand Held & Modular Hard Drive Duplication
- Comprehensive line of PC Hardware

REFERENCES

Over the years Aberdeen LLC has been privileged to work with companies that share similar expectations and professional goals to its own such as unmatched customer service, personal and professional integrity, honest communication and the commitment to forming long-term partnerships.

The innovative Stirling "Backup Monster" storage server impressed Tawfik Daoud, senior system engineer of Maximus Inc. enough to praise Aberdeen in a recent letter. Mr. Daoud mentioned that he chose Aberdeen since the "Backup Monster" costs considerably less than the closest competitor and was "amazed" with the ease of implementation and performance. Mr. Daoud goes on to write in his testimonial.

"The "Backup Monster" is one step ahead in the backup industry and what I like most is that Aberdeen is backing it up."

The Stirling S21 Server appealed to David Featherstone, a network administrator for Timber Products, a company of 1,500 employees, who told PC Magazine how happy he is with the Stirling brand server and that he plans to purchase more in the future.

"Over the years, I've tried everything," Mr. Featherstone says. "I have built my own servers, or bought them from major vendors, but I really like these. The value you get for your money is impressive."

Satisfied clients are the best reference for Aberdeen. Below includes a sample of some of the world-class companies whose rack mounted server expectations have been exceeded by Aberdeen to the point that they have become frequent repeat customers.

Adventists	Intel	Ohio State University	University of Michigan
Boeing	Lockheed	Paramount Pictures	University of Washington
Computer Sciences Corp	Microsoft	Penn State University	US Army
Cornell University	Motorola	Raytheon	US Navy
Central Intelligence Agency	Northrup Grumann	Stanford University	Vanderbilt University
Dow Chemical	Novartis Pharmaceuticals	Timber Products	Verizon
IBM	Oak Ridge National Lab	UC Lawrence Berkeley Lab	Virgin Entertainment

REVIEWS AND AWARDS

Throughout the years Aberdeen LLC has received praise and critical acclaim for custom built servers and desktop systems. Take a look at these recent comments about Aberdeen Stirling Servers from - ***PC Magazine.***

"The Stirling S17 Merits an Honorable Mention" - ***PC Magazine 2003***

"The least expensive Intel-based server in our roundup, the Aberdeen Stirling S17 offers a lot of power and scalability for the money." - ***PC Magazine 2003***

"We were impressed with the Stirling S17's performance; it generally led the pack in test results" - ***PC Magazine 2003***

"Astonishingly Low Price. Inexpensive, Hardworking Server the Aberdeen Stirling S21 is a good choice." - ***PC Magazine 2002***

"With an Unrivaled five-year warranty … (the Stirling S21) offers comparable components and performance (to IBM)." - ***PC Magazine 2002***

PREVIOUS COMMENTS FROM THE EXPERTS

"The Claymore D90G is the fastest PC we've seen so far." - ***Maximum PC 2001***

"There's No Mystery Here- This One's a Beast … Aberdeen's Loch Ness machine is a tower of power." – Loch Ness D80G - ***Maximum PC 2001***

"Aberdeen shows us what a real gaming system should be all about with its latest computer." – Loch Ness D45G - ***PC Gamer Editors' Choice 1999***

APPENDIX - A

ABERNAS 106

ABERDEEN ABERNAS 106 SPEC SHEET

ABERNAS 106

MAXIMIZE:

- Network Storage Capacity
- Hardware Redundancy and Reliability
- Network Performance
- Management Simplicity
- Scalability
- Cost / GB Ratio
- Peace of Mind with a 5-Year Warranty

Inevitably you will need to replace or increase the capacity of your network storage, application server storage or back-up storage. The AberNAS by Aberdeen allows you to enjoy the benefits of a feature-rich, high-performance network attached storage without the high cost of ownership. The AberNAS by Aberdeen is the solution of choice to provide the power and features to support today's most dynamic and demanding network infrastructures. Packed with server management, security and mission-critical features the AberNAS by Aberdeen provides the best priced entry NAS appliance with the AberNAS 106.

As the ultimate reliable NAS server, the AberNAS 106 stresses value, speed, ease of management and dependable storage.. Configured with four ultra fast SATA drives, the cost efficient AberNAS 106 can provide the best valued small business NAS storage appliance solution. Yielding the best storage capacity, the a 1U AberNAS 106 storage appliance allows for a RAID 0, 1, or 5 storage environment thus offering flexibility and speed without sacrificing on security.

ABERNAS 106

For the system/storage administrator, managing an organization's growing wealth of information has become an increasingly complex, high pressure undertaking.

Microsoft® Windows® Powered

Microsoft® Storage Server 2003.

The system administrator must take into account rapidly changing storage technologies. While there are many storage solutions available today, not all solutions scale well with organizational growth, nor are all equally capable of delivering cost-effective high performance solutions.

The new and enhanced data and storage management capabilities of Microsoft® Windows Server 2003 and Microsoft Windows Storage Server 2003 are critical tools in helping system and storage administrators do more with less.

SPECIFICATIONS	
MODEL	AberNAS 106
FORM FACTOR	1U, 19" Rackmount
BASE CAPACITY	640 Gigabytes
PROTOCOL SUPPORT	CIFS, NFS, NCP, HTTP and FTP
MAX RAID 0 CAPACITY	640 Gigabytes
MAX RAID 1 CAPACITY	320 Gigabytes
MAX RAID 5 CAPACITY	480 Gigabytes
MAX SINGLE ARRAY SIZE	640 Gigabytes
OPERATING SYSTEM	Windows® Storage Server 2003
PROCESSOR	Intel Pentium 4 2.4GHz at 533MHz Front Side Bus 512K Cache
MEMORY	512MB ECC Reg. DDR SDRAM
RAID ENVIRONMENT	Integrated Marvell 4 port RAID controller
HOT SWAP	4 Bays
INCLUDED OS / DATA DRIVES	4 x 160GB SATA 8MB Cache - 8GB OS Partition per Drive - 152GB DATA Partition per Drive
ETHERNET	Dual Intel Gigabit controller 2 x 10/100/1000 ports
ETHERNET LOAD BALANCING	Load Balancing, Teaming and Failover
POWER SUPPLY	350w
RAILS	Included
WARRANTY	5-Year Limited

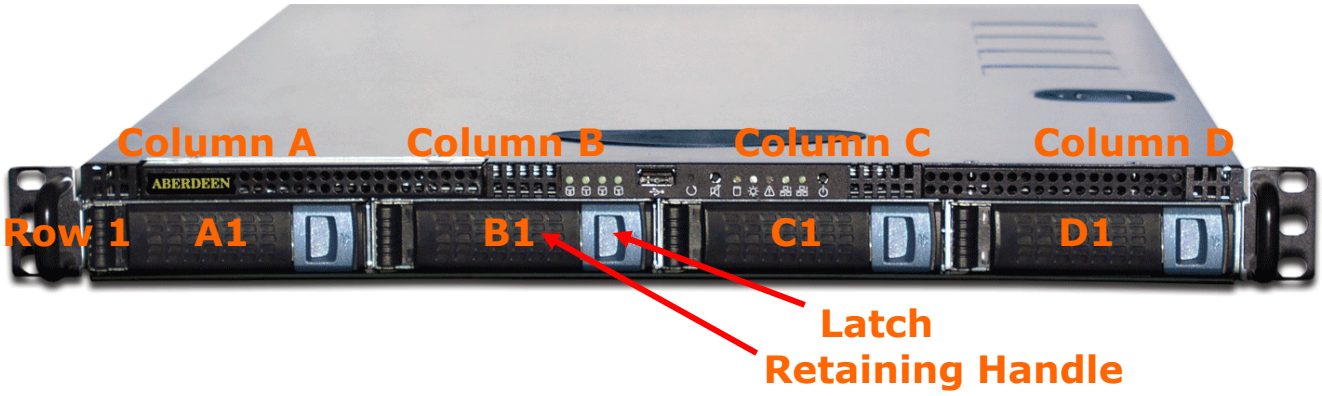
ABERNAS 106 DISK PLACEMENT CHART

WARNING – The disk drive trays must be properly seated completely back into their sockets and they must be in their proper positions in order to avoid software corruption and/or hardware damage.

Please carefully read the following:

Your AberNAS by Aberdeen storage appliance has one row of four hard disk drives. The columns are labeled alphabetically from left to right. For safety during shipment to you, the drives have been removed and shipped separately.

The positioning stickers on the hard drive packages correspond to their placement in the chassis. Proper placement of the drives is critical in retaining the integrity of any software or operating system that has been loaded.



Slide the hard drive into place with the retaining handle extended. When the drive is fully inserted, push the retaining handle back until it is fully seated and snapped into the latch.

Should you require technical assistance with this or any other aspect of your Aberdeen server, contact us toll free at (800)552-6868 option 2 from 8:00am to 5:00pm PST.

APPENDIX - B

ABERNAS 110/116

ABERDEEN ABERNAS 110/116 SPEC SHEET

MAXIMIZE:

- Network Storage Capacity
- Hardware Redundancy and Reliability
- Network Performance
- Management Simplicity
- Scalability
- Cost / GB Ratio
- Peace of Mind with a 5-Year Warranty

ABERNAS 110

Inevitably you will need to replace or increase the capacity of your network storage, application server storage or back-up storage. The AberNAS by Aberdeen allows you to enjoy the benefits of a feature-rich, high-performance network attached storage without the high cost of ownership. The AberNAS by Aberdeen is the solution of choice to provide the power and features to support today's most dynamic and demanding network infrastructures. Packed with server management, security and mission-critical features the AberNAS by Aberdeen can offer up to 1TB (terabyte) in a 1U space with the most competitive value in the marketplace.

As the ultimate reliable NAS server, the AberNAS 110 stresses speed, ease of management and dependable storage.. Configured with four ultra fast 250GB SATA drives, the AberNAS 110 can provide a RAID 0, 1, or 5 storage environment. Yielding the best storage capacity, the a 1U AberNAS 110 storage appliance offers flexibility and speed without sacrificing on security.

AberNAS 110
AberNAS 116

For the system/storage administrator, managing an organization's growing wealth of information has become an increasingly complex, high pressure undertaking.

Microsoft® Windows® Powered

Microsoft® Storage Server 2003.

The system administrator must take into account rapidly changing storage technologies. While there are many storage solutions available today, not all solutions scale well with organizational growth, nor are all equally capable of delivering cost-effective high performance solutions.

The new and enhanced data and storage management capabilities of Microsoft® Windows Server 2003 and Microsoft Windows Storage Server 2003 are critical tools in helping system and storage administrators do more with less.

SPECIFICATIONS	
MODEL	AberNAS 110/116
FORM FACTOR	1U, 19" Rackmount
BASE CAPACITY	1.0 Terabyte / 1.6 Terabyte
PROTOCOL SUPPORT	CIFS, NFS, NCP, HTTP and FTP
MAX RAID 0 CAPACITY	1.0 Terabyte / 1.6 Terabyte
MAX RAID 1 CAPACITY	1/2 Terabyte / 800 Gigabyte
MAX RAID 5 CAPACITY	2/3 Terabyte / 1.0 Terabyte
MAX SINGLE ARRAY SIZE	1.0 Terabyte / 1.6 Terabyte
OPERATING SYSTEM	Windows® Storage Server 2003
PROCESSOR	Intel Pentium 4 2.8GHz at 800MHz Front Side Bus 512K Cache
MEMORY	512MB ECC Reg. DDR SDRAM
RAID ENVIRONMENT	Integrated Marvell 4 port RAID controller
HOT SWAP	4 Bays
INCLUDED OS / DATA DRIVES	4 x 250GB / 400GB SATA 8MB Cache - 8GB OS Partition per Drive - 242GB / 392GB Partition per Drive
ETHERNET	Dual Intel Gigabit controller 2 x 10/100/1000 ports
ETHERNET LOAD BALANCING	Load Balancing, Teaming and Failover
POWER SUPPLY	350w
RAILS	Included
WARRANTY	5-Year Limited

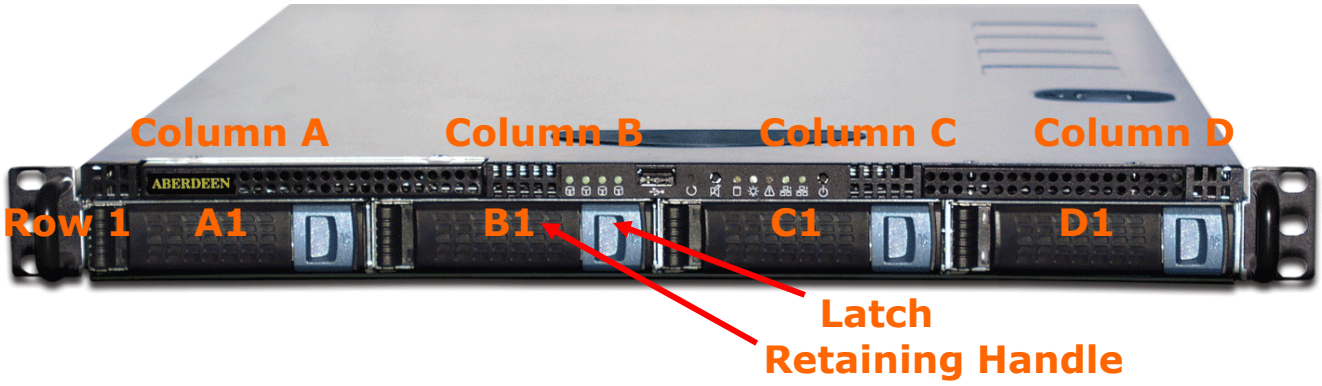
ABERNAS 110/116 DISK PLACEMENT CHART

WARNING – The disk drive trays must be properly seated completely back into their sockets and they must be in their proper positions in order to avoid software corruption and/or hardware damage.

Please carefully read the following:

Your AberNAS by Aberdeen storage appliance has one row of four hard disk drives. The columns are labeled alphabetically from left to right. For safety during shipment to you, the drives have been removed and shipped separately.

The positioning stickers on the hard drive packages correspond to their placement in the chassis. Proper placement of the drives is critical in retaining the integrity of any software or operating system that has been loaded.



Slide the hard drive into place with the retaining handle extended. When the drive is fully inserted, push the retaining handle back until it is fully seated and snapped into the latch.

Should you require technical assistance with this or any other aspect of your Aberdeen server, contact us toll free at (800)552-6868 option 2 from 8:00am to 5:00pm PST.

APPENDIX - C

ABERNAS 221

ABERDEEN ABERNAS 221 SPEC SHEET

MAXIMIZE:

- Network Storage Capacity
- Hardware Redundancy and Reliability
- Network Performance
- Management Simplicity
- Scalability
- Cost / GB Ratio
- Peace of Mind with a 5-Year Warranty

ABERNAS 221

Featuring 3DM Disk Management Software.

Inevitably you will need to replace or increase the capacity of your network storage, application server storage or back-up storage. The AberNAS by Aberdeen allows you to enjoy the benefits of a feature-rich, high-performance network attached storage without the high cost of ownership. The AberNAS by Aberdeen is the solution of choice to provide the power and features to support today's most dynamic and demanding network infrastructures. Packed with server management, security and mission-critical features the AberNAS by Aberdeen can offer up to 2 terabytes in a 2U space with the most competitive value in the marketplace.

As the ultimate reliable NAS server, the AberNAS 221 stresses speed, ease of management and dependable storage.. Configured with separate mirrored OS drives to provide system failover, the AberNAS 221 provides a RAID 5 hot spare storage environment. Yielding the best storage capacity the a 2U AberNAS 221 storage appliance offers flexibility and speed without sacrificing on security.

AberNAS 221

For the system/storage administrator, managing an organization's growing wealth of information has become an increasingly complex, high pressure undertaking.

Microsoft® Windows® Powered

Microsoft® Storage Server 2003.

The system administrator must take into account rapidly changing storage technologies. While there are many storage solutions available today, not all solutions scale well with organizational growth, nor are all equally capable of delivering cost-effective high performance solutions.

The new and enhanced data and storage management capabilities of Microsoft® Windows Server 2003 and Microsoft Windows Storage Server 2003 are critical tools in helping system and storage administrators do more with less.

SPECIFICATIONS	
MODEL	AberNAS 221
FORM FACTOR	2U, 19" Rackmount
BASE CAPACITY	2.0 Terabytes
PROTOCOL SUPPORT	CIFS, NFS, NCP, HTTP and FTP
MAX RAID 0 CAPACITY	2.00 Terabytes*
MAX RAID 1 CAPACITY	1.00 Terabyte*
MAX RAID 5 CAPACITY	1.75 Terabytes*
MAX SINGLE ARRAY SIZE	2.0 Terabytes
OPERATING SYSTEM	Windows® Storage Server 2003
PROCESSOR	Dual Intel Xeon 2.4GHz at 533MHz Front Side Bus 512K Cache
MEMORY	2GB ECC Reg. DDR SDRAM
RAID ENVIRONMENT	3ware® Escalade 8506-12
HOT SWAP	12 Bays
INCLUDED MIRRORED OS/DATA DRIVES	2 x 80GB SATA 8MB Cache - 10GB OS Partition - 70GB DATA Partition
INCLUDED DATA DISK DRIVES	8 x 250GB SATA 8MB Cache
ETHERNET	Dual Intel Gigabit controller 2 x 10/100/1000 ports
ETHERNET LOAD BALANCING	Load Balancing, Teaming and Failover
POWER SUPPLY	460w Dual Hot Swap REDUNDANT
RAILS	Included
WARRANTY	5-Year Limited
* Includes a 140 GB Base RAID 1 Partition	

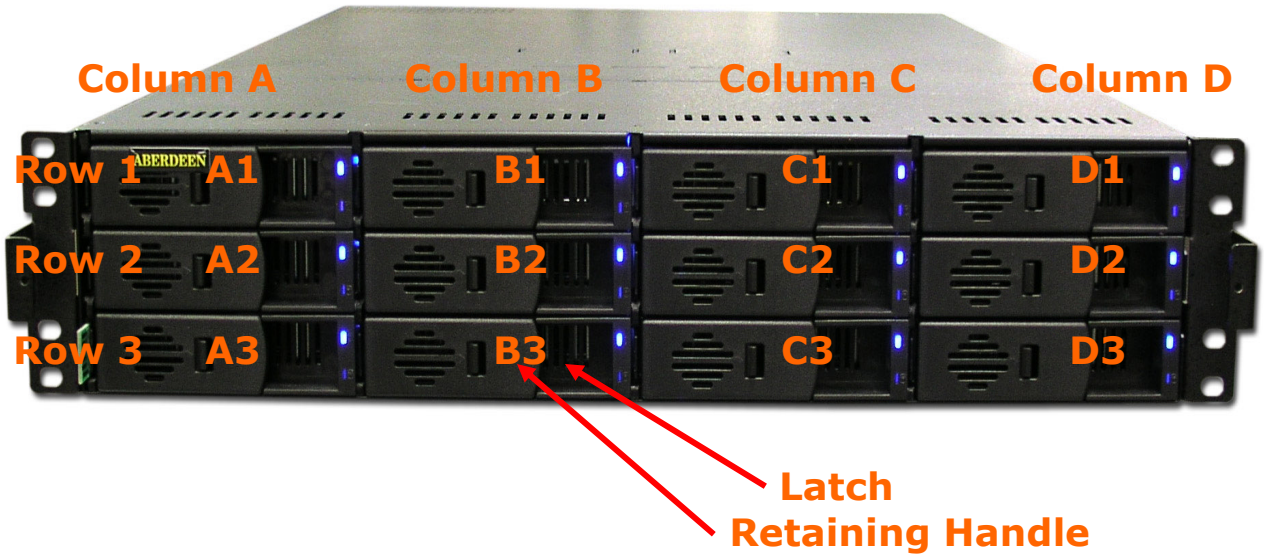
ABERNAS 221 DISK PLACEMENT CHART

WARNING – The disk drive trays must be properly seated completely back into their sockets and they must be in their proper positions in order to avoid software corruption and/or hardware damage.

Please carefully read the following:

Your AberNAS by Aberdeen storage appliance has four columns of three hard disk drives. The columns are labeled alphabetically from left to right and the rows are numbered from top to bottom. For safety during shipment to you, the drives have been removed and shipped separately.

The positioning stickers on the hard drive packages correspond to their placement in the chassis. Proper placement of the drives is critical in retaining the integrity of any software or operating system that has been loaded.



Slide the hard drive into place with the retaining handle extended. When the drive is fully inserted, push the retaining handle back until it is fully seated and snapped into the latch.

Should you require technical assistance with this or any other aspect of your Aberdeen server, contact us toll free at (800)552-6868 option 2 from 8:00am to 5:00pm PST.

APPENDIX - D

ABERNAS 231/232

ABERDEEN ABERNAS 231/232 SPEC SHEET

MAXIMIZE:

- Network Storage Capacity
- Hardware Redundancy and Reliability
- Network Performance
- Management Simplicity
- Scalability
- Cost / GB Ratio
- Peace of Mind with a 5-Year Warranty

ABERNAS 231

ABERNAS 232

Featuring 3DM Disk Management Software.

Inevitably you will need to replace or increase the capacity of your network storage, application server storage or back-up storage. The AberNAS by Aberdeen allows you to enjoy the benefits of a feature-rich, high-performance network attached storage without the high cost of ownership. The AberNAS by Aberdeen is the solution of choice to provide the power and features to support today's most dynamic and demanding network infrastructures. Packed with server management, security and mission-critical features the AberNAS by Aberdeen can offer up to 3 terabytes in a 2U space with the most competitive value in the marketplace.

As the ultimate reliable NAS server, the AberNAS 231 stresses speed, ease of management and dependable storage.. Configured with separate mirrored OS drives to provide system failover, the AberNAS 231 provides a RAID 5 hot spare storage environment. Yielding the best storage capacity the a 2U AberNAS 231 storage appliance offers flexibility and speed without sacrificing on security.

The AberNAS 232 is configured just as the 231 model yet is provides even more TB capacity with the use of 400GB drives.

ABERNAS 231
ABERNAS 232

For the system/storage administrator, managing an organization's growing wealth of information has become an increasingly complex, high pressure undertaking.

Microsoft® Windows® Powered

Microsoft® Storage Server 2003.

The system administrator must take into account rapidly changing storage technologies. While there are many storage solutions available today, not all solutions scale well with organizational growth, nor are all equally capable of delivering cost-effective high performance solutions.

The new and enhanced data and storage management capabilities of Microsoft® Windows Server 2003 and Microsoft Windows Storage Server 2003 are critical tools in helping system and storage administrators do more with less.

SPECIFICATIONS	
MODEL	AberNAS 231/232
FORM FACTOR	2U, 19" Rackmount
BASE CAPACITY	3.0 Terabytes / 4.8Terabytes
PROTOCOL SUPPORT	CIFS, NFS, NCP, HTTP and FTP
MAX RAID 0 CAPACITY	2.74 Terabytes / 4.39 Terabytes*
MAX RAID 1 CAPACITY	1.49 Terabytes / 2.39 Terabytes *
MAX RAID 5 CAPACITY	2.24 Terabytes / 3.59 Terabytes *
MAX SINGLE ARRAY SIZE	2.0 Terabytes / 3.2 Terabytes
OPERATING SYSTEM	Windows® Storage Server 2003
PROCESSOR	Dual Intel Xeon 2.4GHz at 533MHz Front Side Bus 512K Cache
MEMORY	2GB ECC Reg. DDR SDRAM
RAID ENVIRONMENT	3ware® Escalade 9506-12
HOT SWAP	12 Bays
INCLUDED MIRRORED OS/DATA DRIVES	2 x 250GB / 400GB SATA 8MB Cache - 10GB OS Partition - 240GB / 390GB DATA Partition
INCLUDED DATA DISK DRIVES	10 x 250GB / 400GB SATA 8MB Cache
ETHERNET	Dual Intel Gigabit controller 2 x 10/100/1000 ports
ETHERNET LOAD BALANCING	Load Balancing, Teaming and Failover
POWER SUPPLY	460w Dual Hot Swap REDUNDANT
RAILS	Included
WARRANTY	5-Year Limited
* Includes a 240 GB Base RAID 1 Partition w/ 250GB drive and 390 GB Base RAID 1 Partition w/ 400GB drive	

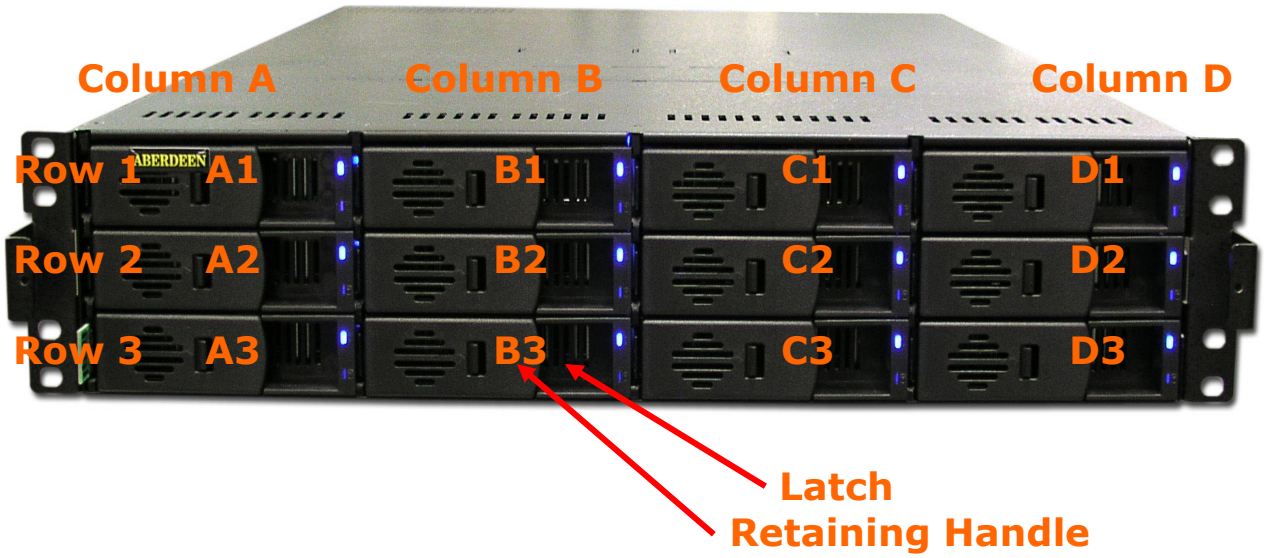
ABERNAS 231/232 DISK PLACEMENT CHART

WARNING – The disk drive trays must be properly seated completely back into their sockets and they must be in their proper positions in order to avoid software corruption and/or hardware damage.

Please carefully read the following:

Your AberNAS by Aberdeen storage appliance has four columns of three hard disk drives. The columns are labeled alphabetically from left to right and the rows are numbered from top to bottom. For safety during shipment to you, the drives have been removed and shipped separately.

The positioning stickers on the hard drive packages correspond to their placement in the chassis. Proper placement of the drives is critical in retaining the integrity of any software or operating system that has been loaded.



Slide the hard drive into place with the retaining handle extended. When the drive is fully inserted, push the retaining handle back until it is fully seated and snapped into the latch.

Should you require technical assistance with this or any other aspect of your Aberdeen server, contact us toll free at (800)552-6868 option 2 from 8:00am to 5:00pm PST.

APPENDIX - E

MICROSOFT WINDOWS STORAGE SERVER 2003

ABERNAS BY ABERDEEN EASY SETUP

If you connect a monitor (1024x768x85Hz resolution), a keyboard and a mouse to your Aberdeen NAS Server for easy setup purposes:

Power up the device and Login as:
User: Administrator
Password: monster

The easy Graphical User Interface (GUI) NAS interface will start. Click on "Administer this Server Appliance" and a detailed help menu embedded into interface will appear. If you see a connection error on Internet Explorer, simply click "Try Again."

If you don't want to connect your Aberdeen NAS Server to a monitor, keyboard and a mouse:

Connect the server to your network, turn it on and allow it approximately two (2) minutes to boot up. Go to any computer connected to the same network, open up your web browser and type https://abernas:8098

Enter the default login information:
User: Administrator
Password: monster

The easy Graphical User Interface (GUI) NAS interface will start. Click on "Administer this Server Appliance" and a detailed help menu embedded into interface will appear. If you see a connection error on Internet Explorer, simply click "Try Again."

If your network has a special IP Number or a Layer 2-3 switch and there is no DHCP Server present on your network, second method may not function and it will be necessary to install a monitor, keyboard and mouse on the NAS Server.

Changing the RAID Array Setup (Only for Experienced Administrators)

Entering https://abernas:888 on any browser will give you access to the RAID Array setup. If you change your Server name, replace "monster" with your server name.

Menu Access

To Manage Disk Volumes or Remote Desktop menus, you must be using Internet Explorer 5.5 or higher. For other menus, any web browser application should function properly.

Introduction to Windows Storage Server 2003 Architecture and Deployment

Microsoft Corporation
Published: July 2003

Abstract

Microsoft Windows® Storage Server 2003 is the latest version of Windows Powered NAS. Built on the Microsoft® Windows Server™ 2003 operating system, Windows Storage Server 2003 is a dedicated file server that offers dependable storage while integrating seamlessly with the existing corporate network infrastructure. Easy to install and manage, Windows Storage Server 2003 offers outstanding economics. It enables substantial file server consolidation and provides one of the best platforms for simplified file sharing, backup and replication of businesses essential data.

This white paper introduces the reader to the new and enhanced features of Windows Storage Server 2003 file server and network attached storage (NAS) technologies.

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Introduction

Development of technologies delivering storage over the network has revolutionized the availability, distribution and accessibility of storage resources. Attaching storage directly to the company network helps to eliminate or reduce the drawbacks business experience when using directly attached storage. These drawbacks include:

- Limited storage capacity and scaling constraints as data assets grow.
- Proliferation of computer hardware and software to meet increased storage capacity needs.
- Proliferation of hardware and software necessary to protect the data allocated to new storage.
- Increased management complexity for the system administrator(s) configuring and maintaining IT client and server systems.
- Poor or inconsistent protection of data on client desktops and laptops.
- Limited or laborious access to data, especially between company workgroups, departments and branches.
- Temporary or permanent loss of data resulting from hardware failures, data corruption or user error.
- Spiraling costs associated with capital expenditure, increased staffing, and production downtime resulting from data loss.

Network attached storage (NAS) is one solution to these challenges. NAS storage and file serving devices can be attached directly to the company intranet. Storage directly attached to the network becomes accessible to all computers that can access the network. NAS servers are designed for ease of deployment: they can be plugged directly into the network without disruption of services, management is minimal and simplified, and they are largely maintenance free. NAS devices are an ideal means by which to consolidate file servers and backup equipment and to expand storage capacity.

A second networked-storage solution is the installation of a storage area network (SAN). Unlike NAS solutions, these dedicated storage networks require considerably more planning to deploy, and their management is more complex. SAN solutions are ideal for database and on-line processing applications requiring rapid data access, but because SAN storage devices serve block-level data rather than files, the installation of a Fibre Channel network to transport the SCSI (Small Computer System Interface) commands is necessary[1].

A third storage network solution is a hybrid one: NAS devices can be attached to SANs. In this configuration, the NAS components necessary for filing are physically separated from the components necessary for storing: a NAS “head” or “gateway” (containing the filing functionality) attaches to the LAN network, and behind that lies the storage component—a “backend” SAN consisting of the Fibre Channel network (wiring and switches) and the storage disks.

[1] Microsoft, with its iSCSI initiator software released in June 2003, is enabling block transport over company intranets. See the Enterprise Storage Division white paper, “Microsoft Support for iSCSI” for details.

Overview of Windows Storage Server 2003

What is Windows Storage Server 2003?

Microsoft® Windows® Storage Server 2003 is a network attached storage (NAS) operating system that enables original equipment manufacturers to build appliances that provide dedicated file serving capabilities and storage on the network. Windows Storage Server 2003 is built on top of Microsoft Windows Server™ 2003, which ensures that NAS devices built upon the Windows Storage Server operating system have all the performance and scalability benefits associated with Windows Server 2003.

A NAS appliance built Windows Storage Server 2003 is designed to perform without requiring a monitor, keyboard and mouse. Instead, this "headless" appliance is remotely managed through a Web-based user interface for the minimal configuration tasks required for setup. Unlike application servers which require proper planning to implement well, NAS devices built with Windows Storage Server 2003 are designed to be deployed in under 15 minutes, and can be attached directly to the company local area network (LAN) with no interruption to services. Once plugged in, these NAS devices require minimal maintenance.

Unlike proprietary solutions, Windows Storage Server 2003 works with standard hardware[2] from multiple original equipment manufacturers (OEMs). This gives businesses maximum flexibility in choosing among vendors with the hardware solution that best meets their needs.

Advantages of Windows Storage Server 2003

Windows Storage Server 2003 is designed for simplicity, reliability and performance. NAS appliances built on Windows Storage Server operating system integrate seamlessly into the IT network to provide one of the most economical file serving and network attached storage solutions available to departmental and enterprise-sized businesses.

- **Ease of Deployment.** Depending on the expertise of the system administrator and the complexity of the computing environment, installation of an application or general purpose server can take anywhere from several hours to a day or more of work. Because Windows Storage Server 2003 comes preconfigured, other than using the web browser interface to set up users and shares, the only installation work necessary is plugging the device into the company LAN. In less than 15 minutes, gigabytes to terabytes of storage can be made available to users across multiple OS platforms.
- **Simple Management**. Windows Storage Server 2003 can be managed remotely though Terminal Services sessions or through a Web browser interface from any desktop on the network. Because Windows Storage Server 2003 uses the Windows operating system, administrators already familiar with Windows do not have to learn a new NAS operating system.
- **Dependability**. Windows Storage Server 2003 is designed to fully support redundant hardware components—disks, power supplies and fans—to provide continuous and uninterrupted availability should a hardware failure occur. And because NAS devices are designed this way, the potential points of hardware failure are fewer than with general purpose servers.

[2] Any system designed to run an operating system.

- **Enhanced Data Protection**. Through built-in point-in-time shadow technology, Windows Storage Server 2003 helps businesses keep their data online 24x7 year-round. Using the infrastructure provided by Windows Server 2003 Volume Shadow Copy Service (VSS), the system administrator can use point-in-time shadow copy technologies to make up to 512 snapshots per volume using NTBACKUP (of which 64 are reserved for Shadow Copies for Shared Folders). These shadow copy backups are available for rapid restores should the need arise. Unlike tape backups which can take hours to restore, these shadow copy backups can be restored in minutes.

The end user can also benefit from point in time imaging technologies, using the Shadow Copies for Shared Folders (SCSF) feature. SCSF enables users to restore accidentally deleted or overwritten files or entire folders without the need for IT intervention. A maximum of 64 SCSF per volume can be created.

- **ISV Utility Support**. NAS devices developed with Windows Storage Server 2003 include all of the benefits of application support available in Windows Server 2003. Critical ISV utilities, such as antivirus, backup, replication and disk quota software, are immediately available and supported in Windows Storage Server 2003. NAS devices *not* based on Windows Storage Server 2003 are not able to support these kinds of products without special versions, *or* those operational procedures must be performed from application servers on the NAS files and file.
- **Robust Security**. Because it can be integrated seamlessly with Active Directory services, Windows Storage Server 2003 can take advantage of the Windows security features such as data and file encryption, network authentication, secure network transport, and network wide group policies.
- **Load Balancing and Server Fail Over**. Windows Storage Server 2003 integrates effectively with the Distributed File System, enabling effective management of the servers and files on the business network. DFS works to provide a single hierarchical view all the servers and their shares. Replicating the data across multiple servers and keeping the data synchronized with File Replication Service (FRS) is an effective way to balance the network load. In the event that a server fails, DFS will automatically redirect clients to the closest available server.

The Basics: How NAS Works

This section provides a brief introduction to how the NAS server works, and is included to help provide the context for many of the NAS features available with Windows Storage Server 2003. Like all NAS servers, Windows Storage Server 2003 functionally and architecturally consists of three components: the filing system, the wiring (and related hardware), and the storage (disk[3]). These components together provide the functionality necessary to fulfill client system application requests for data stored on the NAS device.

Application requests to read or write data are initiated by the client system, and can be directed to the storage local to the client (embedded or directly attached storage), or can be *redirected* over the network to the NAS device using network transport protocols. These I/O requests are then processed by the NAS operating system before being passed to the disk devices for storage.

File Serving Component

The process of storing and retrieving the data requested by user applications is known as file serving. File serving is under control of the operating system software.

1. Application I/O requests (to read or write data) flow from client-side applications over the LAN to the NAS operating system (kernel), which queues and schedules the various client application requests. These requests then pass to the file system and the volume manager of the operating system.
2. The file system portion of the operating system controls security and determines whether or not a file can be created, opened, written to. The file system also ensures that the file is addressed to the correct storage destination. The I/O request then passes from the file system through the Volume Shadow Copy Service layer (where it may or may not be processed) to the volume manager.
3. The volume manager portion of the operating system readies the data for the specific device(s) it will be passed onto for storage[4]. The Virtual Disk Service (see later section in this paper) is a component of the volume manager (but not a component of I/O requests).

Hardware Component

Having passed out of the operating system, the I/O request travels over the host bus to the host I/O controller, which is responsible for correctly addressing the appropriate storage device and correctly transferring the I/O request commands and data across the storage I/O bus to the storage device.

Storing Component

Having passed into the storage device, the application request (data) is stored on the appropriate physical or logical disk, as directed by the file system.

---

[3] Disks can be both physical and logical (virtual).

[4] It is at this step that the data associated with the application request is converted from file format into the constituent granular blocks that are written to storage devices.

Optimizing NAS

Vendors can configure NAS hardware (and firmware[5]) such that it is optimized for network file I/O processing and storage. These components include the NAS processor, memory and caching, and the storage devices. There are many different ways to optimize file serving, and the particular approaches taken are vendor specific.

The next section describes the networking, file serving and storage features in Windows Storage Server 2003 that drive these capabilities.

[5] Software on the vendor hardware; not part of the OS.

Windows Storage Server 2003 Features

This section highlights the networking, file serving and storing capabilities of Windows Storage Server 2003. This section provides feature highlights. For a summary of the major advances in Windows Storage Server 2003, see “Key Improvements Since Windows Powered NAS 2.0.”

Networking

Network Data Transmission Protocols

In order for clients to access storage on the NAS device, they must be connected to the local area network, and network transport must be enabled. Clients most commonly connect to the NAS server over Ethernet cabling using the TCP/IP protocol. Depending on the system platform, other protocol layers may also be necessary for network transport. Windows Storage Server 2003 provides support for network protocols used by not only Windows systems, but also by Unix and Apple systems (see Table 1), enabling networking across multiple platforms.

Table 1. Networking Protocols Supported by Windows Storage Server 2003

Network Protocols	Additional Information
TCP/IP	Used to connect hosts to the Internet.
AppleTalk	Networking protocol for Apple computers.
IPX	Internet packet exchange. (Administration through Remote Desktop.)
NetBEUI	NetBIOS Extended User Interface, used for Windows environments.
SNMP	Simple Network Management Protocol, internet standard for network management.
Telnet	Provides remote terminal access to host.
Fibre Channel	Transmits block-level data; most common in SAN configurations.
Ethernet	Physical network, transmits files; most common transport for NAS.

Network Security

Windows Storage Server 2003 uses the authentication services of Server 2003 to ensure that only those users with permission to access data can do so. An additional layer of protection is available through the data encryption capabilities of the Windows operating system (see Table 2). The NAS Windows Storage Server is able to support security features for Unix and Macintosh environments, as well as earlier Windows platforms.

Table 2. Security and Authentication Support in Windows Storage Server 2003.

Security and Authentication	Additional Information
Kerberos	Network authentication protocol for client server configurations.
SSL	Secure Socket Layer protocol, provides connection security for Web servers.
IPsec	Internet Protocol Security, provides encryption for network transmission.
Active Directory	Directory service for Windows OS, acts as central authority for network security.
Windows NT Domain	Administration (including security and authentication) of users, groups, servers etc in NT environments.
NTLM	Windows NT LAN Manager provides security for connections between NT clients and servers.
NIS	Network Information System (for Unix servers).
Apple UAM	User Authentication Module.

File Serving

File Sharing Protocols

File serving, as discussed earlier, is the process of opening, closing, reading and writing files. In order for file serving to be enabled over the network, file sharing protocols must be supported. These protocols enable clients to make requests and receive responses from remote devices, such as a NAS storage box.

Many NAS devices enable only simple file processing because they include support only for the standard file systems: the Common Internet File System (CIFS) and Network File System (NFS). In contrast, Windows Storage Server 2003, with its support for multiple file sharing protocols (Table 3), allows for complex multi-platform file processing. In addition to Windows clients, Windows Storage Server 2003 supports file processing for Unix, Macintosh, and Web HTTP clients, among others.

Table 3. File Sharing Protocols Supported in Windows Storage Server 2003

Protocols	Additional Information
SMB/CIFS	Enables Windows-based file sharing.
NFS	Enables Unix/Linux-based file sharing. NFS 3.0 supported in Windows Storage Server 2003.
AppleTalk	Enables Apple file sharing.
HTTP	Enables web file sharing.
WebDAV	Enables desktop users to manage web based files using HTTP.
NetWare	Enables Novell-based file sharing. Administration through Remote Desktop.

Supported Utilities and Applications

Although one of the advantages of NAS is that it is a dedicated file server and not overburdened with applications, the data on the server nevertheless requires protection from data corruption, and the possibility of hardware failure. Because it is based on Server 2003 operating system, Windows Storage Server 2003 is able to support anti-virus and backup utilities (see Table 4). In addition, Windows Storage Server 2003 seamlessly integrates with critical Windows features, such as DFS and FRS.

Table 4. Software Supported in Windows Storage Server 2003

Software Support	Additional Information
Anti-virus	Via third party software.
Backup	Via third party software. Includes the backup utility NTBACKUP which uses VSS and SCSF to backup both system and user data with shadow copies.
Distributed File System (DFS)	Enables a single hierarchical mapping of all systems and shares on the network
File Replication Service (FRS)	Enables remote mirroring through replication Synchronizes data[1]
Internet Information Services (IIS)	Tool to host and manage web pages on intranet or internet. Version 6.0 supported in Windows Storage Server 2003.

[1] Web UI support for Distributed File System (DFS) does not include or enable FRS scenarios.

Storage

Managing Storage Devices

Management and configuration of the storage disks (both physical and logical) is under control of the Virtual Disk Service (VDS). (See “New Features” for more information.) Allocation of disk space to users is performed through quotas, and can be managed through a user interface.

The Enterprise Edition of Windows Storage Server 2003 supports the Automated Deployment Service (ADS) as an optional add-on. ADS is a scriptable service enabling rapid and highly effective deployment of large numbers of new servers.

Table 5. Disk and Deployment Management Capabilities in Windows Storage Server 2003

Disk Management	Additional Information
Virtual Disk Service (VDS)	Includes sample code for volume management
Quota Management	Enables administrators to limit the storage accessible by each user.
Automated Deployment Services (ADS)	Enterprise Edition only. ADS enables administrators to perform script based administration of large scale deployments of Windows servers. ADS replaces Multi-Device Manager (MDM) in WP NAS 2.0.

Ensuring Availability of Stored Data

A number of existing technologies have been enhanced and a number of new features have been added to Windows Storage Server 2003 to help keep a business’s data highly available. These technologies range from tools to ensure hardware components are operating effectively and at high performance, to technologies enabling hardware (MPIO) and software (clustering) redundancy, to data availability techniques for redundancy (VSS and RAID) and high performance (RAID—redundant array of inexpensive disks).

Table 6. Features Enhancing System Reliability and Data Availability

Reliability/ Availability	Additional Information
Volume Shadow Copy Service (VSS)	Enables up to 512 point-in-time copies per volume, of which 64 are reserved for Shadow Copies for Shared Folders if enabled on the volume. This service replaces the Persistent Storage Manager (PSM) in WP NAS 2.0.
Clustering	Provides application failover. Windows Storage Server 2003 Enterprise Edition supports up to 8 nodes (WP NAS 2.0 supports a maximum of 2 nodes).
Software RAID 0, 1, 5	RAID types provide differing levels of data protection and redundancy. VDS also enables hardware based RAID.
Multipath I/O (MPIO)	Enables high performance and high availability through multiple paths to storage.
System Monitoring	Monitors performance of the operating system. Allows system administrator to assess I/O performance with different devices.
Watchdog Timer	Detects system hangs; can be programmed to reboot system after a given time.

NAS Management Software

Depending on the complexity of the deployment scenario, the need for NAS management ranges from the minimal (plug and play) to the considerably more complex (see Table 5).
Windows Storage Server 2003 provides a number of different interfaces to meet such management needs, including both local and web-based UIs (see Table 7).

Table 7. Management Interfaces in Windows Storage Server 2003

Management	Additional Information
Web User Interface (UI)	Enables administrators to remotely manage users, create shares, and control backups and similar tasks from any location on the network or internet.
Remote Desktop	Enables remote control of other systems for administration.

Key Improvements Since Windows Powered NAS 2.0

Windows Storage Server 2003 has been improved in a number of key areas relative to Windows Powered NAS 2.0. This section highlights improvements in the key areas of file serving performance, integrated snapshots, and the user interface.

Performance

As a dedicated file server, the speed with which NAS boxes can handle I/O read and write requests is a critical factor in overall performance of systems on the network. Windows-based NAS boxes communicate with client systems using the SMB (server messenger block)[6] or CIFS (common internet file system) protocol for Windows-based systems. For Unix-based systems, the NFS (network file system) protocol is used.

SMB Performance

The industry standard in measuring SMB/CIFS file server performance for Windows Clients is NetBenchTM benchmarking software. File server performance is measured as throughput (megabits per second) versus number of clients.

Comparisons of Windows Storage Server 2003 and NAS 2.0 using the same hardware configurations directly capture improvements in the Windows operating system performance. These improvements stem from changes to the kernel (improved caching, buffering, and the like), as well as changes reflected in the use of SMB in 2003 versus CIFS in 2000. Differences between studies capture differences attributable to different hardware configurations.

In both internal MS benchmarks using NetBench and a commissioned 3rd party benchmark test, the performance of Windows Storage Server 2003 is greatly enhanced in comparison to NAS 2.0. In 3rd party Veritest comparison[7] of file serving in Windows Storage Server 2003 and NAS 2.0, peak throughput on Windows Storage Server 2003 is 35-85% faster than Windows Powered NAS 2.0, depending on whether there are one, two, four or eight processors[8] (see Figure 1). Internal Microsoft tests, using a different hardware configuration, put the overall throughput at 100% or above for each of the four processor configurations.

NFS Performance

The industry standard for measuring NFS file server performance for Unix clients is based on the Spec SFS benchmark program produced by the Standard Performance Evaluation Corporation. Spec SFS scores file server performance in terms of I/O throughput per second (IOPS). In internal MS tests[9] using Spec SFS, file serving performance increased from 5040 IOPS in NAS 2.0 to 7500 IOPS in Windows Storage Server 2003, a 50% increase.

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[6] SMB is Server 2003's enhanced version of CIFS (native to Server 2000).

[7] See the report at www.veritest.com/clients/reports/microsoft.

[8] It is important to note that these performance improvements are seen only when upgrade client software is loaded onto the client systems.

[9] For configuration details, see Windows Storage Server 2003 OEM training Guide.

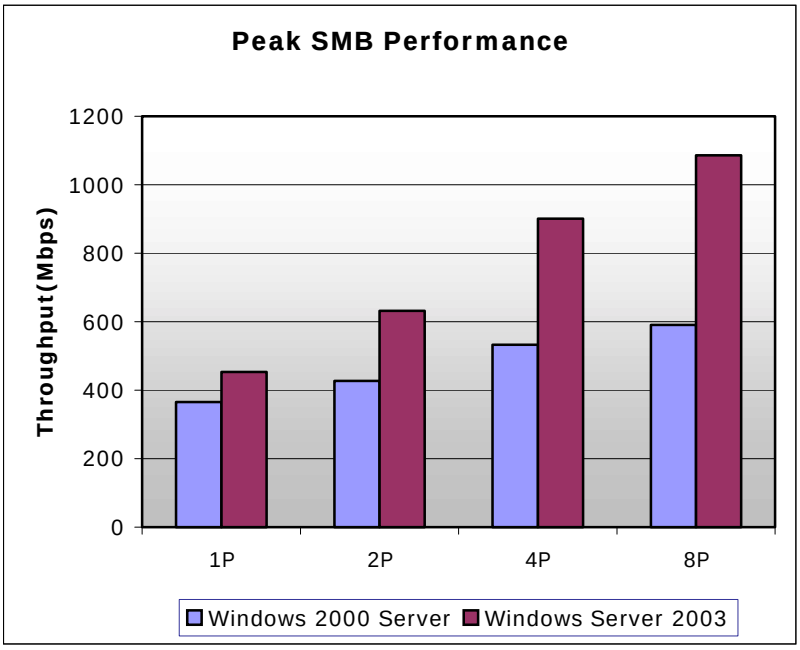

Figure 1. NetBench comparison of file serving performance in NAS 2.0 (Windows 2000 Server) and Windows Storage Server 2003 (Windows Server 2003).

Integrated Snapshots

In NAS 2.0, point-in-time imaging (snapshot) technology is only available through the integration of 3rd party advanced backup software. In Windows Server 2003, snapshot technology is part of the Volume Shadow Copy Service (VSS) and is fully integrated into the operating system, thus making it part of the Windows Storage Server 2003 package. Snapshot technology enables open file backups and fast restores. The technology is especially useful when the goal is the restoration of individual files, which can be done by the end user without the need for system administrator intervention.

Improved End-User Experience

Windows Storage Server 2003 has a number of enhanced user interfaces (UIs) for the end user and the system administrator. On the client side, the Previous Versions user interface (Shadow Copies for Shared Folders) allows end users to directly restore their own files in the event of accidental deletion, overwriting or file corruption (Figure 2). On the system administrator side, UIs for volume defragmentation, task scheduling, folder and share management, volume management, and UPS management make administration of storage much more convenient than before.

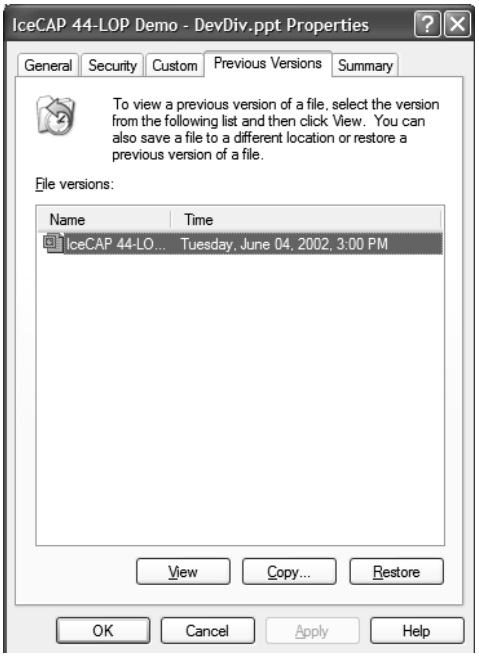

Figure 2. Client user interface used to restore previous versions of a file.

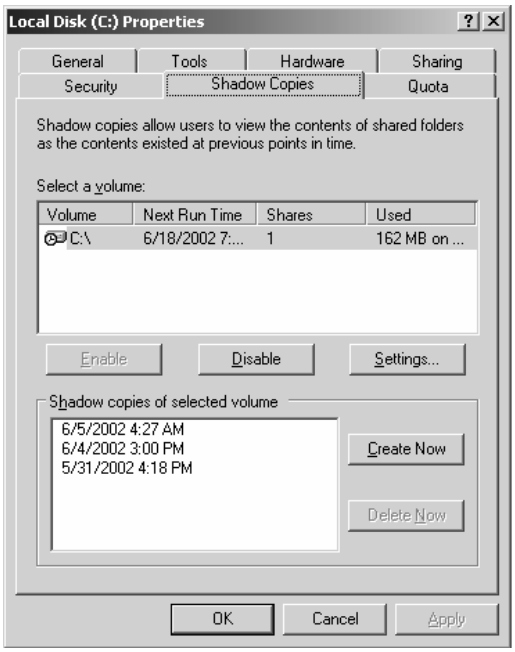

Figure 3. System administrator user interface for scheduling shadow copies.

New Features in Windows Storage Server 2003

The following are new features in Windows Storage Server 2003.

- Volume Shadow Copy Service
- Virtual Disk Service
- MPIO
- DFS

Volume Shadow Copy Service (VSS)

The Volume Shadow Copy Service (VSS) is an infrastructure that makes possible enhanced data protection though high fidelity backups, rapid data restores, and data transport.

VSS is a component of the operating system, and as such, is not directly accessed by users. Instead the Volume Shadow Copy Service coordinates with user applications, backup applications and storage hardware to enable the creation of point-in-time shadow copies of data on single or multiple volumes without significantly impacting performance.

High Fidelity Backups

Shadow copy creation is a highly effective means of protecting data with several advantages over traditional tape backups when the goal is not long-term archiving. Tape-based technologies are time-intensive to run, impose a considerable bandwidth burden on the local network, and can have data inconsistency issues if applications are open during the backup process. As a consequence, tape backups tend to be scheduled relatively infrequently and at times when applications are not in use (such as nights or weekends)—a strategy that can work reasonably well for companies that do not require 24x7 operations. In contrast, shadow copies can be created in seconds, without the impact on network traffic that tape backups impose. Additionally, because the shadow copy process allows open files to be backed up without data inconsistency issues, they can be scheduled at any time, and much more frequently than tape backups.

Fast Restores

In the event of data loss, shadow copy restoration offers significant advantage over tape restores. Because the shadow copies can be saved on storage arrays on site, they can be accessed directly, without the need to travel offsite to a tape data vault, locate and bring back a tape. Even more significantly, shadow copy restores takes only minutes to complete, while tape restores, depending on the type of backup (full, differential or incremental) and the amount of data, can take hours or even days to do correctly.

Shadow Copies for Share Folders

System administrators are not the only people to benefit from the fast restore functionality enabled by VSS. System administrators can activate Shadow Copy for Shared Folders, thereby enabling end users who overwrite or accidentally delete a file to restore a previous version of a file for themselves, rather than having to recreate the file or request that a system administrator do a high cost single file restore from tape.

Shadow Copy Transport

All of the functionality discussed above is provided with the in-box shadow copy technology on the operating system. The exception to this is shadow copy transport among systems—whether for backup, data mining, testing or fast restores—which requires a hardware provider on the SAN. In a direct attached storage configuration, this data transport between servers is physical. In a NAS-SAN configuration with pooled storage, data on the SAN can be accessed (through masking and unmasking) between servers. Although access to the storage pool is shared, each server can only access the specific LUNs (Logical Unit Number) assigned to it (since two servers cannot both write to the same volume without potentially causing data corruption). But using the hardware provider on the SAN, a point-in-time shadow copy can be virtually "transported" to another server for use, through the process of masking and unmasking.

Virtual Disk Service (VDS)

In order for a server to use new storage disks, they must first be made accessible to the server and then formatted for use. Virtual Disk Service (VDS) controls the process of making storage accessible to systems that need it. While it is irrelevant to application (or the user) how the data is stored—whether it is on a single physical disk or spanned across several disks (a logical unit), in terms of data protection and performance, the impact of how the data is stored is significant. Thus VDS can either present a physical disk or a logical disk to a server. Physical disks do not require the first two steps.

1. Create logical units, assign number ids (these are now referred to as LUNs)
2. Unmask LUNs to server
3. Create partitions and volumes
4. Format the file system

- **Basic Disks**. VDS is used to partition[10] each physical disk and to create the volumes that can be mapped to drive letters for use. These volumes are known as "simple volumes" and do not span multiple disks. Basic disks are the legacy disks, predating Windows 2000 capabilities. They do not offer the same performance and data protection that dynamic disks offer.
- **Dynamic Disks**. VDS can be employed to create dynamic disks which can consist of either simple volumes or multi-partition volumes[11]. Multi-partition volumes physically span more than a single disk but nevertheless are logically considered a *single* volume. Dynamic disks can be spanned, striped (RAID-0), mirrored (RAID-1) or stripped with parity (RAID-5), depending on the level of performance and data protection desired. VDS can be used to expand dynamic disks to make more space available to a volume.

[10] Physical disks are divided into sectors; contiguous sectors are partitions. In the case of basic disks, the volumes are created within partitions, and are thus restricted to a single disk.

[11] Volumes can span one or more partitions on the same or multiple disks. Dynamic disk types include RAID configurations, and can offer better performance and reliability than basic disks.

Although many vendors provide NAS appliances preconfigured with RAID, system administrators might want to use VDS to customize the storage solution to meet specific data storage needs, whether relating to capacity, performance or data protection.

VDS can also be used to attach a NAS device to a back-end SAN. These NAS “heads” contain only the file serving capabilities; for highly scaleable and highly available pooled storage, they plug into a Fibre Channel SAN. Each storage unit on the SAN must have its storage configured and made accessible to the appropriate servers only. Since it is common for storage on the SAN to be from multiple hardware vendors, prior to Windows Server 2003 and Windows Storage Server 2003 it was necessary for the system administrator to configure each device using a vendor-specific storage management application. Not only did this mean using hardware-specific management utilities, it frequently meant that the system administrator had to physically go to each storage device to do each configuration.

Windows Storage Server 2003’s Virtual Disk Service helps alleviate these administration complexities in a NAS backend SAN configuration by providing a single management interface for multivendor storage devices. The system administrator can manage all storage devices directly from a single management console, and query and configuration operations are common across all managed devices.

In this scenario, VDS functionality is enabled through hardware vendor support. Each hardware vendor must supply a VDS “provider” for the storage hardware. The hardware provider translates the VDS standard APIs (application programming interface) into instructions specific to the storage device. With communication enabled between the Virtual Disk service and the storage hardware, the system administrator can now use a single storage management interface to communicate with multivendor storage devices.

Multipath I/O (MPIO)

Multiple or redundant paths between storage devices and the systems that use them enable persistent data availability and high I/O performance. In essence, these technologies provide for an alternate connection in case of failure of the primary I/O path, and, optionally, multiple paths to improve performance or balance loads.

MPIO software included in Windows Storage Server 2003 is not a feature of the operating system, but is supported through the Driver Development Kit (DDK). Multipathing allows a host to have up to 32 paths to access an external storage device, which facilitates failover and load balancing. Multipathing technology is critical in ensuring highly available data to businesses. In the past, multipathing was a solution only available to large scale enterprises; now this high availability solution is available to any organization using only Windows Storage Server 2003 (and Windows Server 2003) technologies.

Microsoft's MPIO delivers a standard and interoperable path for communication between storage products and Windows Server. With a platform upon which multiple third-party storage systems can reliably interoperate, businesses have greater choice when building a high-quality, highly available network storage system, and system administrators will have the flexibility to incorporate products from multiple vendors into a single, interoperable and highly available storage infrastructure.

Distributed File System (DFS)

The Distributed File System enables the system administrator to create single hierarchical mapping of all systems and shares on the network. By uniting files on different computers into a single namespace, users do not have to sort through a network of dozens of servers, each with their own separate directory structure, but instead see the files as if they resided on a single computer.

With the latest version of the server operating system, DFS has been enhanced to allow multiple DFS roots on a single server, thus reducing administrative and hardware costs of managing multiple namespaces and multiple replicated namespaces. In addition, DFS now delivers more reliable load-balancing, better file replication between DFS sites and servers, and closest-site selection for users accessing the network. Closest-site selection ensures that in the event of server failure or scheduled maintenance, users are automatically routed to another server on the network that has a replica of the data. For best performance and lowest cost, clients are rerouted to the site closest to them.

NAS Deployment Scenarios

The following are common NAS deployment scenarios.

- File Serving
- Server Consolidation
- Local and Remote Site Replication for Business Continuity
- NAS-SAN Fusion

File Serving

Businesses need reliable file servers that can provide highly available data at a reasonable cost. Off-the-shelf, general-purpose servers are not typically configured with fully redundant hardware components. Using a general-purpose server for file serving and running applications can compromise both tasks. In particular, file serving can be negatively impacted by the overhead associated with running applications, as well as by the risks of system crashes should an application fail. General-purpose servers have the additional disadvantage of being platform specific, necessitating a different file server to serve clients on different platforms.

In contrast, NAS filers confer a number of advantages. NAS appliances are designed for high reliability: they are built with redundant disks, NICs (for failover data paths), and power supplies. This redundancy of hardware components makes NAS devices highly reliable file servers helping to ensure highly available data.

Because NAS devices built on Windows Storage Server 2003 are dedicated file servers, they do not carry application overhead, and they are not vulnerable to application-related problems. Moreover, because Windows Storage Server 2003 supports multiple file sharing protocols, file serving to clients on Windows, Unix or Macintosh computers, and sharing between them, can be accomplished without the need for a specialized file server for each platform.

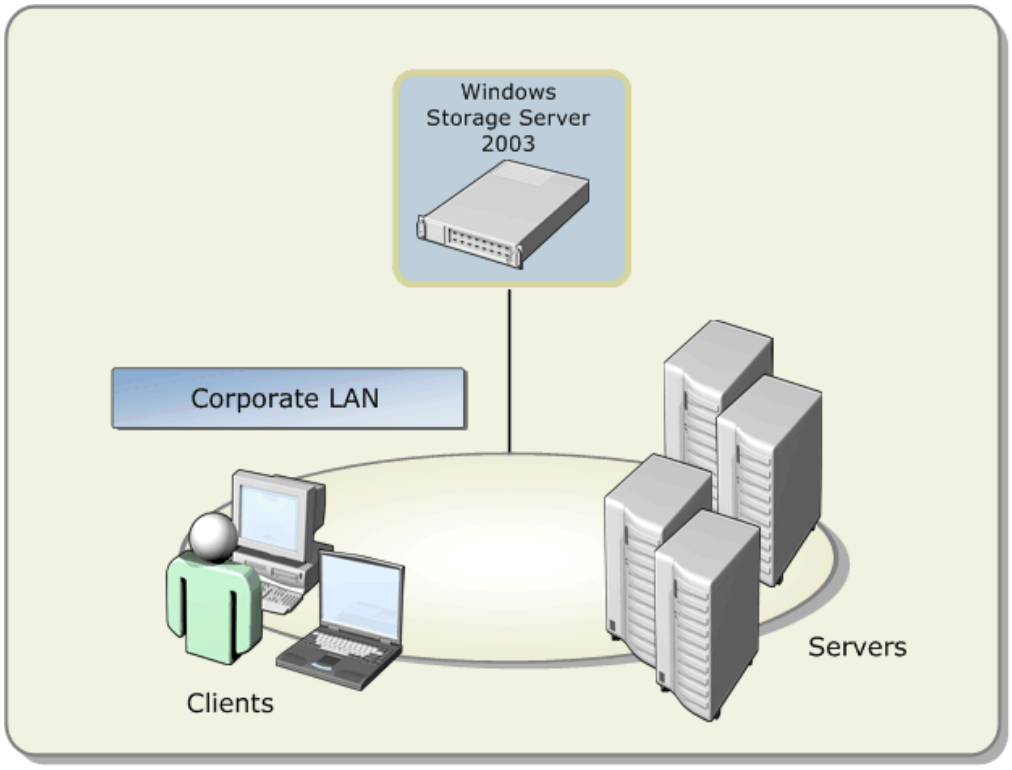

Figure 4. File serving between network clients and Windows Storage Server 2003.

Server Consolidation

As companies add more and more servers to meet demands for increased storage capacity, equipment, licensing, maintenance (power, space, servicing) and management costs all escalate.

Adding a Windows Storage Server 2003 based device to the network allows businesses to consolidate multiple file servers into a single more powerful NAS device. Given the broad file serving capabilities of Windows Storage Server 2003, even file servers running on different platforms (such as Unix or Novell) can be consolidated onto a NAS device, greatly simplifying management across systems. Related equipment, such as backup devices, can also be consolidated. System management is much simpler with fewer devices requiring space, servicing (such as applying patches or maintaining versioning), and backup and restore services. For every NAS device replacing multiple existing servers[12], the associated licensing costs are eliminated.

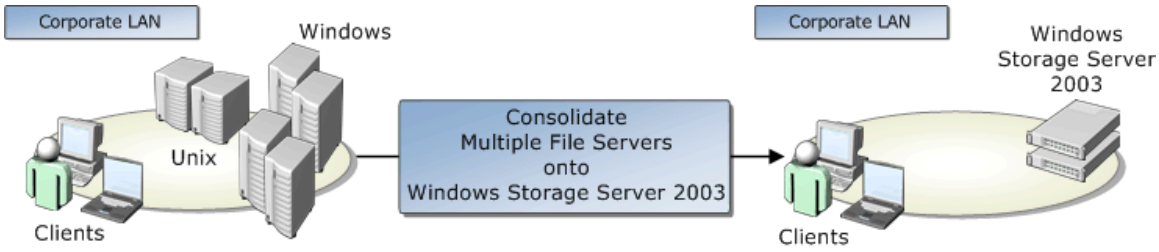

Figure 5. Consolidation of several multi-platform servers onto a single Windows Storage Server 2003 NAS device. This scenario enables the consolidation of tape drives into a single tape array.

Local and Remote Site Replication for Business Continuity

NAS servers using Windows Storage Server 2003 software technologies enable businesses to build fault tolerant solutions designed to keep data highly available.

NAS devices on a LAN can use the replication technologies to replicate data between one NAS device and another. In the event of network failure or the outage of a NAS device, a second NAS device can assume the identity of a nonfunctioning filer and continue serving files to clients without interruption of services. When the nonfunctioning NAS device returns, it takes back its identity, resynchronizes its data with the active NAS device, and resumes file serving.

This process of replication and failover also works on a wide area network (WAN). Replication and synchronization occurs over the WAN between NAS devices. Should one branch site succumb to disaster or be shut down for a planned outage, clients accessing that NAS device are redirected to a second NAS device at a different branch.

NAS devices are also useful to remote sites for a different reason. Branch offices often do not have the IT staffing expertise to effectively deploy general-purpose servers. Because they are so simple to deploy and maintain, NAS file servers are the perfect plug and play solution for these remote sites.

---

[12] The number of servers that can be consolidated on a NAS device depends how powerful the server capabilities are, and how many clients are served. Microsoft tests have demonstrated that up to 25 Widows NT servers can be consolidated into a single NAS device.

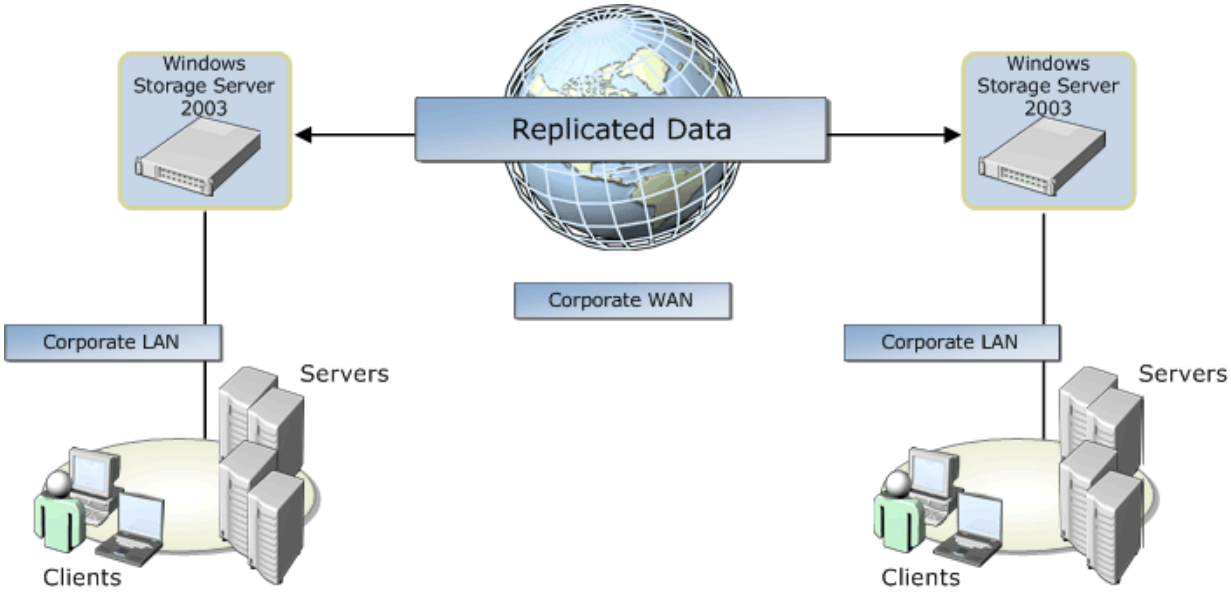

Figure 6. Replication of data between NAS Windows Storage Server 2003 devices deployed at different branch sites.

NAS-SAN Fusion

NAS devices can be seamlessly integrated into a storage area network, providing clients access to unlimited storage. In this configuration, NAS storage is separated from the NAS filing function and placed on the SAN. The NAS head now acts as a gateway to the SAN, controlling distribution of the data over the network and providing clients with maximum scalability and high-performance storage solutions.

NAS-SAN fusion also enables system administrators to move NAS backups off the LAN onto the storage network for highly efficient and extremely fast backups that do not impact LAN performance.

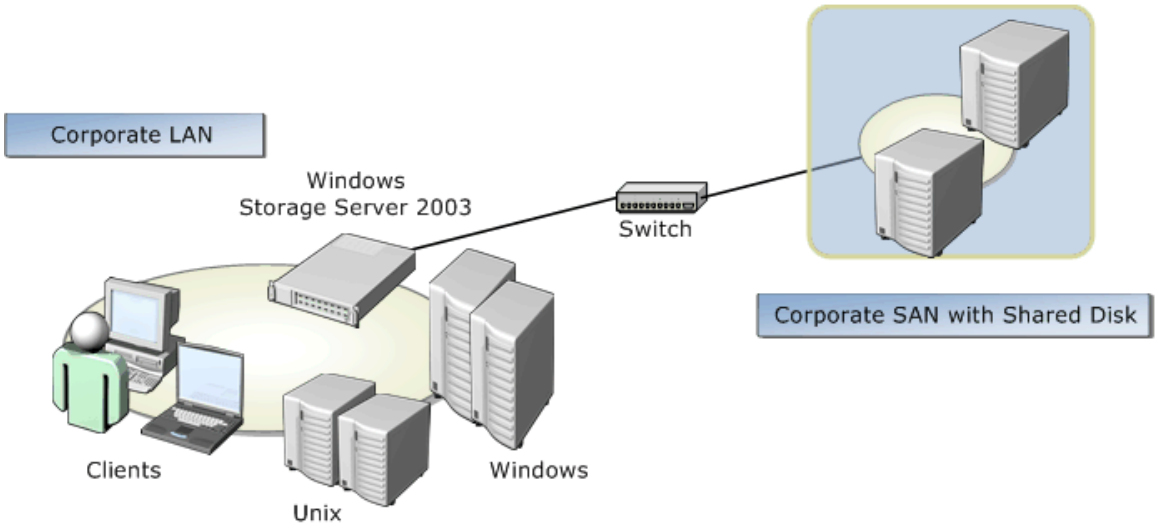

Figure 7. Windows Storage Server 2003 (NAS "head") integrated into storage area network.

Summary

Windows Storage Server 2003 provides scalable, high performance storage solutions to businesses of all sizes. Built on the Windows Server 2003 operating system, this successor to Windows Powered NAS broadens usability and interoperability for both end users and system administrators. Using Shadow Copies for Shared Folders, end users are empowered to recover their own lost data without IT intervention, thereby improving their own efficiencies and helping the business save money. System administrators benefit from the seamless integration of Windows Storage Server 2003 into existing networks, multi-platform file-serving capabilities, and built-in point in time imaging capabilities for highly efficient backup and restores.

Related Links

See the following resources for further information:

- Microsoft Windows Network Attached Storage Home at http://www.microsoft.com/windows/storage/default.mspx
- Windows Server 2003 File Server, Web Server, and Active Directory Performance Testing (4/03) at www.veritest.com/clients/reports/microsoft
- Microsoft Windows Server 2003 vs. Linux Competitive File Server Performance Comparison (4/03) at www.veritest.com/clients/reports/microsoft

APPENDIX - F

3WARE ESCALADE CONTROLLER

3DM

DISK MANAGEMENT UTILITY

Introduction:
The 3DM disk management utility allows you to view status and version information pertaining to your Escalade ATA RAID Controller. 3DM alerts you when a disk array needs maintenance, and you can maintain your disk arrays from 3DM. You can add or remove drives, specify an available drive as a hot spare or launch the rebuild process. Array status can be viewed or arrays can be maintained remotely via a standard web browser provided you have access to the network containing the Escalade ATA RAID Controller.

Event notification occurs from 3DM when the ATA RAID controller requires attention, such as when a disk array becomes degraded and is no longer fault tolerant. Event notification will only occur while 3DM is running, so we recommend that 3DM be left running as a background utility on the ATA RAID controller's machine. The event notification e-mail feature can send an e-mail to a specified recipient when 3DM detects a problem within the array. The e-mail received will include most of the information provided in the Logs on the Alarms page.

Documentation:
The online manual and user guide is available to download on the Aberdeen Website. http://www.aberdeeninc.com/abcatg/Aberdeen-AberNAS-3ware.pdf

Troubleshooting:
Common usage concerns with the 3DM Utility and the 3Ware Escalade controller.

Soft Reset - A "Soft Reset" message window will appear on the desktop upon each restart of the system. This is normal for the 3DM software as it treats each restart of the system as a reported incident.

Power Status Lights – Each unit includes hard disk drive power status LEDs.

Hot Swap - With 3Ware, "activity" is the key word. Soft Reset will notify that the system is being shut down and re-starting.

Error Reporting – There is no error reported when a drive is removed while the system is powered up and inactive. 3Ware management software will immediately report a drive missing or defective when there is read or write activity addressed to that drive. The constant polling of the drives was deemed by 3Ware to be a performance degrading overhead activity and unnecessary.

RAID Control - The mirroring of the operating system drives is controlled by the Microsoft software and not by the 3Ware controller.

AMCC STORAGE

User Guide

3ware®

Serial ATA RAID Controller

Supports the 9000 Series

PN 720-0104-00
April, 2004

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3ware Disk Manager (3DM 2)

Note: 3DM 2 includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

3ware Disk Manager 2 (3DM 2), allows you to view the status of and manage 3ware RAID controllers and associated drives. 3DM runs as a service under Microsoft Windows, and as a daemon under Linux. When it is running, you can use your browser to view status and perform administrative tasks locally or remotely.

3DM 2 can display information about 3ware RAID 7000-, 8000- and 9000-series RAID controllers. However, some version 2 features are only available for 9000-series controllers.

Two levels of access are provided: user and administrator. Users have view-only access—they can check the status of drives and units—while Administrators can view and make changes, using 3DM to configure RAID units and designate hot spares, and to perform maintenance tasks on RAID units.

In this section, information about 3DM is organized into the following topics:

- "Browser Requirements for 3DM" on page 28
- "Installing 3DM" on page 29
- "Starting 3DM and Logging In" on page 35
- "Working with the 3DM Screens" on page 37
- "Setting Up 3DM Preferences" on page 41
- "Running Two Versions of 3DM" on page 44
- "3DM 2 Reference" on page 45

"3DM 2 Reference"contains information about the fields and settings on each page in 3DM. For additional information about doing particular tasks in 3DM, see the remaining sections in this guide.

Browser Requirements for 3DM

3DM runs in most current web browsers. Tested and supported browsers include:

- Mozilla 1.2 and above
- Internet Explorer 5.5 and above

Additional requirements:

- JavaScript must be enabled
- Cookies must be enabled
- For best viewing, use a screen resolution of 1024 X 768 or greater, and set colors to 16 bit color or greater.

Note: Because 3DM may be viewed in different browsers, the format and style of the 3DM browser windows illustrated in this chapter are examples only. (Screenshots were taken in Internet Explorer.) The actual "look" of the windows will depend on the browser, 3DM version and operating system in use.

Setting up Mozilla

Details about accessing all ports, including port 888, by adding a list of ports to /Mozilla/default/all.js

Note: For security reasons, some web browsers do not allow connections to certain ports including port-1080 and 888. To override this on a per-port basis, the Mozilla release notes recommend to add a comma-separated list of ports to default/all.js (in your Mozilla installation directory). For example, to unblock port 888, use the following line:

pref("network.security.ports.banned.override", "888")

This file is located at:

`/usr/lib/mozilla/defaults/pref/all.js`

Installing 3DM

3DM 2 can be installed from the main 3ware CD that came with your 3ware RAID controller. You can also download the current version from the website at http://www.3ware.com/support/download.asp.

3DM must be installed on the system in which the controller is installed. 3DM does not have to be installed on remote systems in order to remotely manage a 3ware controller.

During installation, you will be asked to enter the following preferences for 3DM use. (Each of these preferences can be changed later, from within 3DM.)

- The HTTP port to be used as the listening port
- Whether remote access will be allowed
- Whether you want email alerts to be sent when errors occur, and who should receive them

Installing 3DM on a Windows system

The 3ware RAID controller works with Windows 2000, Windows XP, and Windows Server 2003. The latest service packs should be installed for any Windows release.

To install 3DM on a Windows system

1 Insert the 3DM CD-ROM and click **Install 3DM 2** when the menu appears.

Or, if you downloaded 3DM from the website, find the file 3DM2_x86.exe or 3DM2_AMD64.exe and double-click it to launch the setup.

2 If a command window opens, press any key to begin the installation process.

3 When the License Agreement screen appears, read and agree to the license information; then let the InstallShield Wizard guide you through the installation process.

4 On the **3DM Remote Monitoring and Security Configuration** screen (see Figure 10), use the settings to specify these things:

- To change the HTTP port that 3DM will use as a listening port, check the first box.

  If you do not know which port to use, leave the box unchecked and use the default port.

- To allow remote administration, uncheck the second checkbox.

When the second checkbox is checked, only localhost connections are allowed. Internet and Intranet connections are not allowed.

(You can change this setting later in 3DM.)

3ware 3DM 2 Setup
3DM 2 Remote Monitoring and Security Configuration.
3ware
Check first box to update 3DM 2 HTTP listening port.
Uncheck second box to allow Internet/Intranet connections to 3DM 2
Change 3DM 2 port. [Currently:888]
Restrict to localhost only connections.
InstallShield
< Back
Next >
Cancel

Figure 10. 3DM Remote Monitoring and Security Configuration Display

5 If the **3DM HTTP listening port setup** screen appears, enter the HTTP port you want to use.

This screen only appears when you check the first box on the **3DM Remote Monitoring and Security Configuration** screen.

(You can change this setting later within 3DM.)

6 On the **E-mail Notification Preferences** screen (see Figure 11) use the fields to specify initial email settings.

Note: If you do not want email alerts to be sent to anyone, leave "None" in these fields and click **Next** to go on to the next screen.

- In the **Server** field, enter the name of your email server.

  If you do not know your server name, ask your system administrator or check the e-mail preferences or setup options on your e-mail client.

- In the **Recipients** field, enter the e-mail address of the user who should receive the 3DM e-mail status messages.

  You may enter multiple e-mail addresses, separating each entry with a comma (,).

- In the **Sender** field, enter the email address from which the email notifications will be sent. This is typically the local host name.

(You can change these settings later within 3DM.)

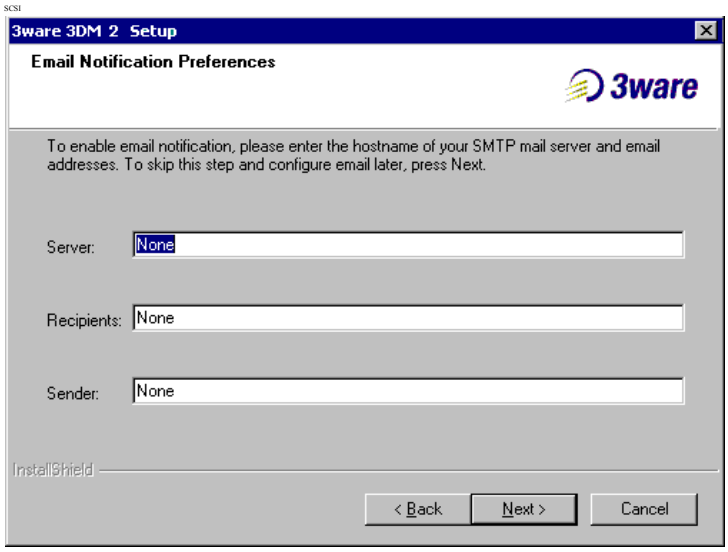

Figure 11. 3DM E-mail Notification Preferences

7 Continue with the installation as prompted, clicking **Next** to move to the next screen, and **Finish** when you reach the last screen.

3DM Installation gives you the option of starting 3DM and opening the browser window.

8 If you elect to launch the web interface, a Security Alert may appear, as shown in Figure 12. Click **Yes** continue.

You may install the certificate if you do not want to see this alert in the future. To do so, click View Certificate and then click Install Certificate.

Security Alert
Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.
The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.
The security certificate date is valid.
The name on the security certificate is invalid or does not match the name of the site
Do you want to proceed?
Yes
No
View Certificate

Figure 12. Security Alert dialog box

9 When the first 3DM screen appears in your browser, log in as Administrator and use the default password, `3ware`.

Notes:
You can start 3DM later by choosing **3DM** from the **Start** menu.

If you change, add, or remove an IP address, or change the machine name of the machine on which you have installed 3DM 2, you will need to recreate the security certificate. You can do so by re-installing 3DM 2, or by deleting the file 3dm2.pem and restarting the 3DM 2 service. Under Windows, this file is located in the same directory in which you installed 3DM 2. Under Linux, the file resides in /etc/3dm2. You may also want to delete the installed/cached security certificate from your browser.

Uninstalling 3DM under Microsoft Windows

Use the Add or Remove Programs control panel to uninstall 3DM.

- From the **Startup** menu, choose **Control Panels > Add or Remove Programs**.
- In the Add or Remove Programs control panel, select **3DM** and click **Change/Remove**.

Installing 3DM for Linux or FreeBSD

You can install 3DM from the command line, or from a GUI. The steps below describe how to install 3DM from the command line. If you are using a GUI, you can access the CD-ROM and folders from the windows in the GUI.

Note: If you downloaded 3DM_Linux.zip from the website, unzip the file to root (or to any other working directory) and change Directory (CD) to that directory (for example: `/root`). Then start the following procedure at step 3, substituting `/mnt` with `/root` or your installation directory.

To start the installation

1 Insert the 3ware software installation CD-ROM for Linux into the CD-ROM drive.

2 Mount the CD-ROM disk:

```
mount /dev/cdrom /mnt
```

3 Change the directory and run the install script:

For Linux:

```
cd /mnt/packages/3dm2/linux/x86
./install.3dm
```

For FreeBSD:

```
cd /mnt/packages/3dm2/freebsd/x86
./install.3dm
```

To specify initial setup for 3DM 2

During installation, you will be prompted with a series of questions that determine initial 3DM settings. You can change these later, from within 3DM.

(The first question appears for Linux, but not for FreeBSD.)

1 `Was RPM used to install the Escalade driver and/or 3DM?`

The default answer is no.

2 `Please enter the location of the help documentation (default is /usr/local/doc/3dm)`

Press Enter to accept the default location and display the next question, or enter the path at which you want the documentation to be installed.

3 `Would you like to have e-mail notification enabled (Y/N)?`

E-mail notification sends an email message when an event occurs.

The default answer to this question is “yes”.

If you enable e-mail notification you will be asked to provide additional information: the name of the mail server, the user name for the person who will send the E-mail notification (typically the local host name) and the user name for the person who will receive the e-mail notification (typically the system administrator).

```
Please enter the name of your mail server: (default is local
host name)
Please enter the name of the user you want sending e-mail
notification: (default is root)
Please enter the name of the user you want receiving e-mail
notification: (default is 3ware_admin)
```

To enter multiple e-mail addresses, separate them by a comma or a semicolon:

4 `Please enter the port number you would like to use for web monitoring (default is 888)`

If you do not know what port to use, select the default:

5 `Would you like 3DM connection security to limit connections to localhost only? (default is yes)`

If you want to be able to use 3DM for remote administration, change this to No.

6 Change the directory and then eject the CD-ROM disk when finished:

```
cd /home
eject cdrom
```

Uninstalling 3DM under Linux or FreeBSD

To uninstall 3DM for Linux or FreeBSD

1 Insert the 3ware software installation CD-ROM into the CD-ROM drive.

2 Mount the CD-ROM disk:

```
mount /dev/cdrom /mnt
```

3 Change the directory and run the uninstall script:

(For FreeBSD, replace “linux” with “freebsd” in the path shown in this step.)

```
cd /mnt/packages/3dm2/linux/x86
./install.3dm --u
```

Note that if you downloaded 3DM from the web, replace “/mnt/” in the previous command with “/root/”

4 Eject the CD-ROM disk when finished:

```
cd /home
eject cdrom
```

Note: If 3DM Linux is reinstalled or restarted, close any open web browsers before starting 3DM again to close the server socket.

Starting 3DM and Logging In

3DM runs as a service under Windows, and as a daemon under Linux.

It is a good idea to leave 3DM running on the system that contains your 3ware RAID controller. That way email alerts can be sent by 3DM, and administrators can manage the controller remotely, if remote administration is enabled.

You can access the 3DM screens to check status information and manage your 3ware RAID controller by logging in to the 3DM screens in your browser.

Starting 3DM under Linux

3DM should start automatically after installation and upon bootup.

To start 3DM manually

1 Login as root.

1 Afterwards, type:

For Red Hat Linux:

```
/etc/rc.d/init.d/3dm start
```

For SuSE Linux:

```
/etc/rc.d/3dm start
```

2 Open your browser and enter the URL for your system.

The default URL is https://localhost:888/.

You can also replace “localhost” with the IP address of the computer that contains the 3ware controller. For example: https://<IP address>:888/

The 3DM login screen appears.

Starting 3DM under Windows

■ From the Start menu, choose **Programs > 3ware > 3DM 2.**

Your default browser opens and displays the URL for your local controller.

The default URL is https://localhost:888/.

You can also replace “localhost” with the IP address of the computer that contains the 3ware controller. For example:

https://<IP address>:888/

Note: If you close your browser, 3DM continues to run in the background on the system.

Viewing 3DM Remotely via a Standard Web Browser

When remote administration is enabled, you can use 3DM to check status and administer your 3ware RAID controller from a browser on any computer, over an internet connection.

You do not need to install the 3DM software on the remote computer.

Remote connections can be enabled or disabled from the 3DM Settings page.

- In the address line of your browser, enter the URL or IP of the system containing the 3ware RAID controller.

  If you don't know the URL or IP for the system, you can contact your network administrator or from a Windows command prompt, type `ipconfig`. From a Linux command prompt, type `ifconfig`.

Logging In

When you first view 3DM in a browser, you must log in before you can view or change any information.

Two levels of access are provided:

- Users can check the status of the controller, units, and drives attached to it.
- Administrators can check status, configure, and maintain the equipment.

(Administrator and User status in 3DM is not related to Administrator/User settings in the operating system.)

To log in to 3DM

1 On the 3DM logon screen, select whether you are a **User** or **Administrator**.

2 Enter your password and click **Login**.

  If you are logging in for the first time after installing 3DM, the default password for both User and Administrator is `3ware`.

Note: If you forget the passwords, uninstalling and reinstalling 3DM resets the passwords to `3ware`.

Working with the 3DM Screens

3DM's features are organized on a series of pages you view in your browser.

After you log in to 3DM, the Summary page shows a list of controllers installed in the computer at the URL you specified.

Note: If you expect to see a controller that is not listed, it may not be compatible with the driver that is loaded; a firmware flash upgrade may be required.

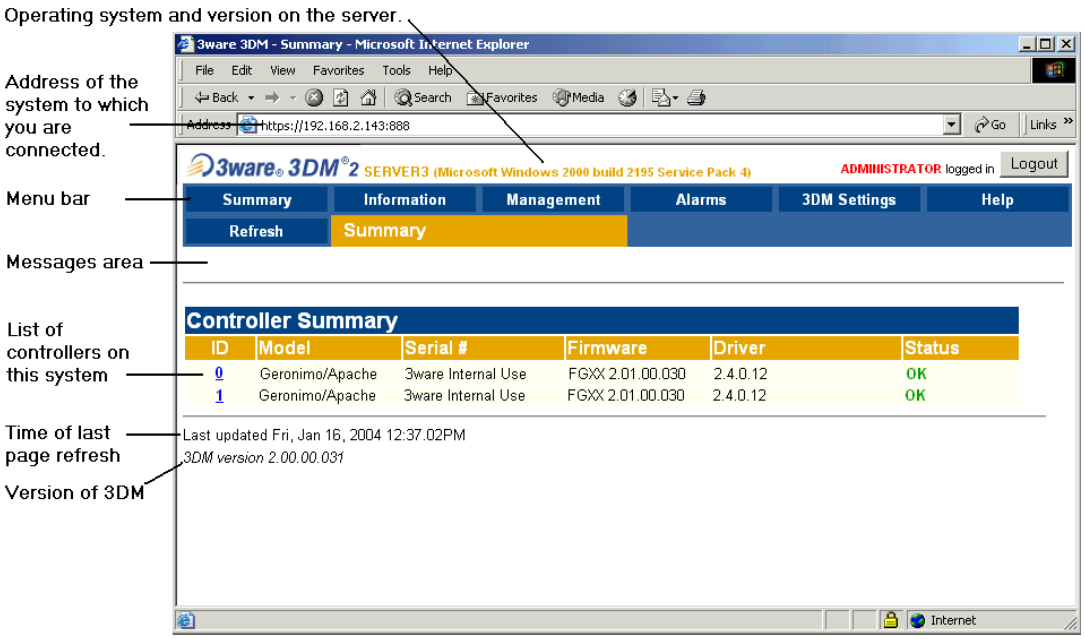
Operating system and version on the server.
Address of the system to which you are connected.
Menu bar
Messages area
List of controllers on this system
Time of last page refresh
Version of 3DM
3ware 3DM - Summary - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://192.168.2.143:888
Go Links
3ware 3DM 2 SERVER3 (Microsoft Windows 2000 build 2195 Service Pack 4)
ADMINISTRATOR logged in
Logout
Summary Information Management Alarms 3DM Settings Help
Refresh
Summary
Controller Summary
ID Model Serial # Firmware Driver Status
0 Geronimo/Apache 3ware Internal Use FGXX 2.01.00.030 2.4.0.12 OK
1 Geronimo/Apache 3ware Internal Use FGXX 2.01.00.030 2.4.0.12 OK
Last updated Fri, Jan 16, 2004 12:37:02PM
3DM version 2.00.00.031
Internet

Figure 13. 3DM Main Screen

The menu bar across the top of the screen gives you access to other pages in 3DM. You can move between pages by using the menu bar, or by clicking a link on the page.

The main area of the page provides summary or detail information about your 3ware RAID controller and the resources connected to it.

As you work in 3DM, the Messages area just below the menu bar displays information about the results of commands you have selected.

3DM Menus

The 3DM menu bar groups access to a number of 3DM pages on menus, and provides direct link access to others.

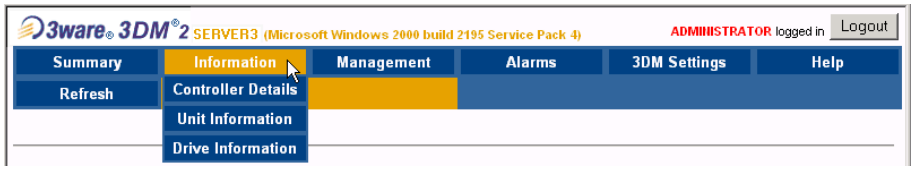

Figure 14. 3DM Menu Bar

Status information is available from the **Information menu**. You can view controller, unit, and drive information for a particular controller.

The **Management menu** gives you access to tasks used for managing controller-level settings (background task rate, enabling of unit write cache, and policies that affect all units managed by the controller), tasks that can be scheduled (rebuild, verify, and self-test), and maintenance of individual units. Unit configuration can also be done through the Management > Maintenance page.

The **Alarms** page shows a list of alarms, including the specific alarm message, and the exact date and time it occurred.

The **3DM Settings** page lets you set preferences, including email notification for alarms, passwords, page refresh frequency, whether remote access is permitted, and the incoming port which 3DM will use for listening.

Help lets you access information about using 3DM, and provides access to an electronic copy of this User Guide.

Viewing Information About Different Controllers in 3DM

If you have more than one controller in the system, you select the one you want to see details about from the drop-down list at the right of the menu bar.

This drop-down is available on all pages that provide controller-specific features.

Note: Throughout these instructions, *current controller* is used to refer to the controller which is currently selected in this drop-down list.

Refreshing the Screen

You can refresh the data on the screen at any time by clicking **Refresh Page** in the menu bar. This causes 3DM to update the information shown with current information from the controller and associated drives.

Automatic refreshes can also be set. For details, see "Setting the Frequency of Page Refreshes" on page 43.

Note: If you click Refresh on the browser window, you will be taken back to the Summary page.

3DM Screens and What They're Used For

Table 5 shows a list of the pages you work with in 3DM and describes what they are used for. Details about each page and the fields and features on it are provided in the section "3DM 2 Reference" on page 45. The page names in Table 5 provide links to details about that page.

Table 5: List of 3DM Pages

3DM Page	Description
Controller Summary Page	Provides basic information about each 3ware RAID controller in your system. To see this page, click Summary in the menu bar.
Controller Details Page	Provides detailed information about the current controller. To see this page, choose **Information > Controller Details** from the menu bar.

Table 5: List of 3DM Pages

3DM Page	Description
Unit Information Page	Shows a list of the units on the current controller and provides summary information about each unit. To see this page, choose **Information > Unit Information** from the menu bar or click an ID number on the Controller Summary.
Unit Details Page	Shows details about a particular unit. To see this page, click an ID number on the Unit Information page.
Drive Information Page	Shows a list of drives on the current controller and provides summary information about each drive. To see this page, choose **Information > Drive Information** from the menu bar.
SMART Details About Drive at Particular Port Page	Shows the SMART data for a specific drive. To see this page, click the Port # for a drive on the Drive Information page.
Controller Settings Page	Lets you view and change settings that affect the units on the current controller. To see this page, choose **Management > Controller Settings** from the menu bar.
Scheduling Page	Lets you view and change the schedule for tasks that affect all units on the current controller. To see this page, choose **Management > Scheduling** from the menu bar.
Maintenance Page	Lets you configure new units and make changes to existing units. To view this page, choose **Management > Maintenance** from the menu bar.
Alarms Page	Shows a list of alarms, including the specific alarm message, and the exact date and time it occurred. To view this page, click **Alarms** on the menu bar.
3DM Settings Page	Lets you set preferences, including email notification for alarms, passwords, page refresh frequency, whether remote access is permitted, and the incoming port which 3DM will use for listening. To view this page, click **3DM Settings** on the menu bar.

Setting Up 3DM Preferences

The 3DM Settings page lets you define preference settings that affect the overall operation of 3DM. Most of these settings are specified initially during installation of 3DM.

On the 3DM Settings page you can perform the following tasks:

- Setting and Changing 3DM Passwords
- Managing E-mail Event Notification
- Enabling and Disabling Remote Access
- Setting the Incoming Port #
- Setting the Frequency of Page Refreshes

Setting and Changing 3DM Passwords

3DM provides different access levels for users and administrators.

The Administrator access level allows the user to fully configure 3DM. The User access level allows the user to view pages within 3DM. These passwords work independently of each other.

The default password for both the User and Administrator is “3ware”.

Passwords are case sensitive.

You can only change passwords if you are logged in as Administrator. If you change the Administrator password, you will be automatically logged out, and must log back in with the new password.

To set or change the password

1 Click **3DM Settings** on the 3DM menu bar.

2 On the 3DM Settings page, in the **Password** section, select the type of password you want to change: **User** or **Administrator**.

3 Type the current password in the **Current Password** field.

If you are changing the password for the first time, the factory-set default password is `3ware`.

4 Enter the new password in the **New Password** field and again in the **Confirm New Password** field.

5 Click the **Change Password** button to enact the change.

Note: If you forget your password, you can uninstall 3DM and then reinstall it. This will reset the password to the default password, 3ware.

Managing E-mail Event Notification

3DM can notify you when the 3ware RAID controller requires attention, such as when a disk unit becomes degraded and is no longer fault tolerant.

Event notification can only occur while 3DM is running, so it is recommended that 3DM be left running on the system that contains the 3ware RAID controller.

When events occur, notification can be e-mailed to one or more recipients. You can specify the type of events for which notifications will be sent by selecting the severity:

- **Information** will send e-mails for all alarms
- **Warning** will send e-mail for alarms with severity of Warning and Error only.
- **Error** will send e-mail for alarms with severity of Error only.

For more information about events and alarms, see "Viewing Alarms" on page 107.

Event notification is initially set up during 3DM installation, but can be changed on the 3DM Settings page.

To set up event notification

1 Click **3DM Settings** on the menu bar.

2 In the **E-mail Notification** section of the 3DM Settings page, enter or change the settings you want.

- Enable or Disable all notifications.
- Set the severity level of events for which e-mail notifications are sent.
- Specify the email address of the sender. This will appear in the "From" field of the e-mail.
- Enter the e-mail address(es) to which notifications are sent. (Separate multiple addresses with a comma (,) or a semicolon (;).
- Enter the SMTP server name or IP of your mail server.

3 Click **Save E-mail Settings**.

To send a test message

You can send a test message to make sure you've entered the e-mail notification settings correctly.

- Click **Send Test Message.**

Enabling and Disabling Remote Access

When remote access is enabled, a user can connect to 3DM over the internet or an intranet, to check status or administer the controller and associated drives.

If remote access is disabled and a user attempts to connect to 3DM remotely, they will see the following error message: “Remote Access to 3DM has been disabled. Please connect using the local machine by entering “localhost” in the URL bar.”

Remote access can be enabled or disabled on the 3DM Settings page.

To enable or disable remote access

1 Click **3DM Settings** on the menu bar.

2 In the **Remote Access** section of the 3DM Settings page, select either **Enabled** or **Disabled** in the **Allow Remote Connections** field.

The page refreshes, and a message at the top of the screen confirms that remote access has been enabled or disabled.

Setting the Incoming Port

You can set the port which 3DM uses to listen for incoming messages. If you are not sure which port would be the best to use, leave this set to the default port of 888.

To set the incoming port

1 Click **3DM Settings** on the menu bar.

2 In the **Incoming Port #** section of the 3DM Settings page, enter the port number in the **Listening Port** field.

The page refreshes, and a message at the top of the screen confirms that the listening port has been changed.

Setting the Frequency of Page Refreshes

Since the status of the drives attached to your 3ware RAID controller can change while you are viewing information about them in 3DM, it’s important to refresh the page information regularly. That way you can be assured that the information you see in 3DM is current.

You can manually refresh the information on a page by clicking **Refresh Page** in the menu bar. But you can also have 3DM refresh the information on a regular basis.

To set the frequency of page refreshes

1 Click **3DM Settings** on the menu bar.

2 In the **Page Refresh** section of the 3DM Settings page, select how often you want the page to be refreshed in the **Minutes Between Refresh** field.

Note: If you don't want 3DM to refresh the screen automatically, select **Never** in the **Minutes Between Refresh** field. You can then refresh manually by clicking Refresh on your web browser.

Running Two Versions of 3DM

Although you can view information about 7000- and 8000-series controllers in 3DM 2, some features of version 2 are only available for the 9000-series, because they require that the firmware contain associated capabilities. When this is the case, a message appears in the 3DM page indicating that the feature is not available for the current controller.

The scheduling feature is one that works differently in 9000-series controllers and earlier controllers. If you want to set the schedule for background tasks for a 7000- or 8000-series controller, you must do so by using 3DM version 1.x.

If you have multiple controllers in the same system, and the controllers are from different series, it is possible to install and run both 3DM 2 and 3DM version 1.x on the same system.

Note: If two different versions of 3DM are both running, they have to be listening on different ports.

In addition, alarms cannot be captured by both versions.

3DM 2 Reference

This section includes details about the fields and features available on the pages you work with throughout 3DM 2. It is organized by page, as the pages are organized on the 3DM menu bar.

- Controller Summary Page
- Controller Details Page
- Unit Information Page
- Unit Details Page
- Drive Information Page
- SMART Details About Drive at Particular Port Page
- Controller Settings Page
- Scheduling Page
- Maintenance Page
- Alarms Page
- 3DM Settings Page

Controller Summary Page

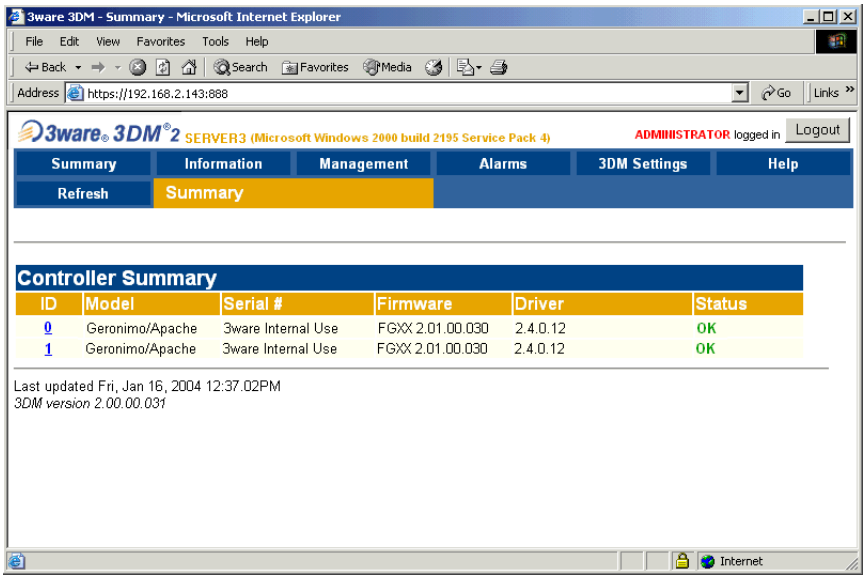
3ware 3DM - Summary - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://192.168.2.143:888
Go Links
3ware 3DM 2 SERVER3 (Microsoft Windows 2000 build 2195 Service Pack 4)
ADMINISTRATOR logged in
Logout
Summary Information Management Alarms 3DM Settings Help
Refresh
Summary
Controller Summary
ID Model Serial # Firmware Driver Status
0 Geronimo/Apache 3ware Internal Use FGXX 2.01.00.030 2.4.0.12 OK
1 Geronimo/Apache 3ware Internal Use FGXX 2.01.00.030 2.4.0.12 OK
Last updated Fri, Jan 16, 2004 12:37:02PM
3DM version 2.00.00.031
Internet

Figure 15. Controller Summary Page

Note: The software version shown in the screenshots in this manual are preliminary examples only. For the current released and tested version number, refer to the 9000 release notes.

The Summary page appears after you first logon to 3DM, and when you click the Summary link in the menu bar.

The Summary page provides basic information about each 3ware RAID controller in your system. To see details about the units in a controller, click the link in the ID column.

ID. The ID that the operating system assigns to the controller.

Note: The controller ID you see in 3DM 2 may not match the number that you see for the same controller in 3DM version 1.x.

Model. The model name of the controller. (The model number is also printed on a sticker on the outside bracket of the controller.)

Serial #. The serial number of the controller. (The serial number is also printed on a sticker on the outside bracket of the controller.)

Firmware. The firmware version running on the controller.

Driver. The driver version being used to interact with the controller.

Status. The overall status of the controller. Possible statuses include OK, Warning, Error, and No Units. **Warning** indicates that a background task is currently being performed (rebuilding, verifying, or initializing). **Error** indicates that a unit is degraded or inoperable. If both Error and Warning conditions exist, the status will appear as Error.

Controller Details Page

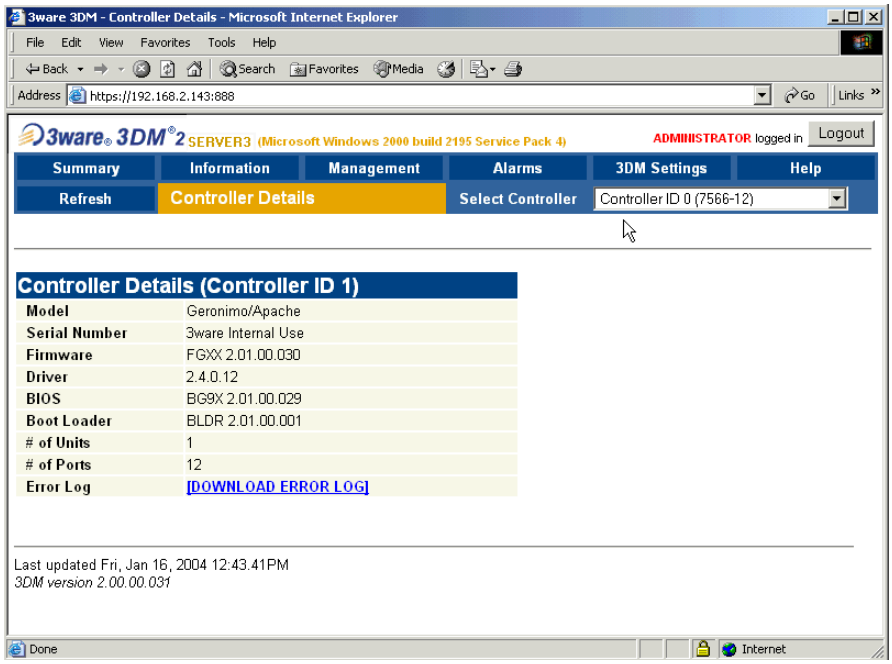

Figure 16. Controller Details Page

The Controller Details page appears when you choose **Information > Controller Details** from the menu bar.

The Controller Details page provides detailed information about the controller specified in the drop-down list on the menu bar.

You can also open or download an error log from this screen.

Model. The model name of the controller.

Serial #. The serial number of the controller.

Firmware. The firmware version running on the controller.

Driver. The driver version being used to interact with the controller.

BIOS. The BIOS version on the controller.

Monitor. The Monitor version on the controller.This field appears only for 7000- and 8000-series controllers.)

Boot Loader. Boot Loader version on the controller. This field appears only for 9000-series controllers.

# of Units. The number of units on the controller.

# of Ports. The number of total ports on the controller, regardless of whether each currently has a drive connected.

Error Log. Provides access to the firmware's error log. When you click this link, a dialog box gives you the option to save the log to your computer, or open it.

Unit Information Page

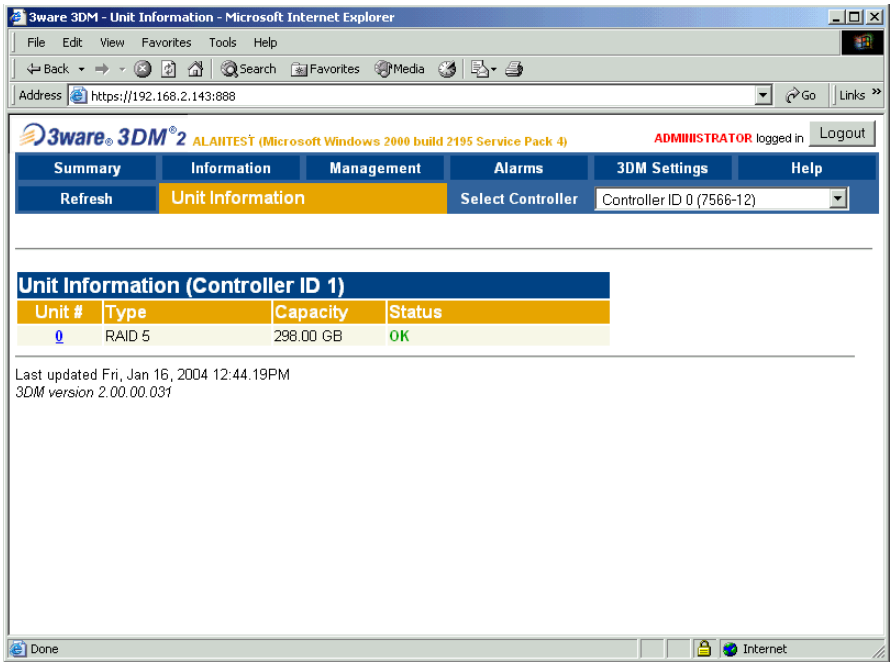

Figure 17. Unit Information Page

The Unit Information page appears when you choose **Information > Unit Information** from the menu bar, and when you click an ID number on the Controller Summary page.

The Unit Information page shows a list of the units on the controller specified in the drop-down list on the menu bar and provides summary information about each unit.

To see details about a particular unit, click the link in the Unit # column.

Unit #. The unit number assigned to the unit by the firmware. For 9000-series controllers, unit numbers are in sequential order. For 7/8000-series controllers, unit numbers begin with the lowest port number.

Type. The type of unit, specified during configuration: RAID 0, RAID 1, RAID 5, RAID 10, RAID 50, Single Disk, JBOD, or Spare. For details about each of the RAID levels, see “Understanding RAID Concepts and Levels” on page 8.

Capacity. The logical capacity (size) of the unit.

Note: 3DM 2 displays the capacity (in MBytes or GBytes) the same way that Microsoft Windows and Linux operating systems do: as 1KB = 1024 bytes. Previous versions of 3DM 1.x used the 1KB = 1000 bytes definition. Consequently capacities of units listed under 3DM v 1.x may appear to be larger than they do under 3DM 2.

Status. The operational status of the unit: OK, Rebuilding, Initializing, Verifying, Degraded, or Inoperable (missing drives). When a unit is Rebuilding, Initializing, or Verifying, the percentage (%) complete is also shown.

Unit Details Page

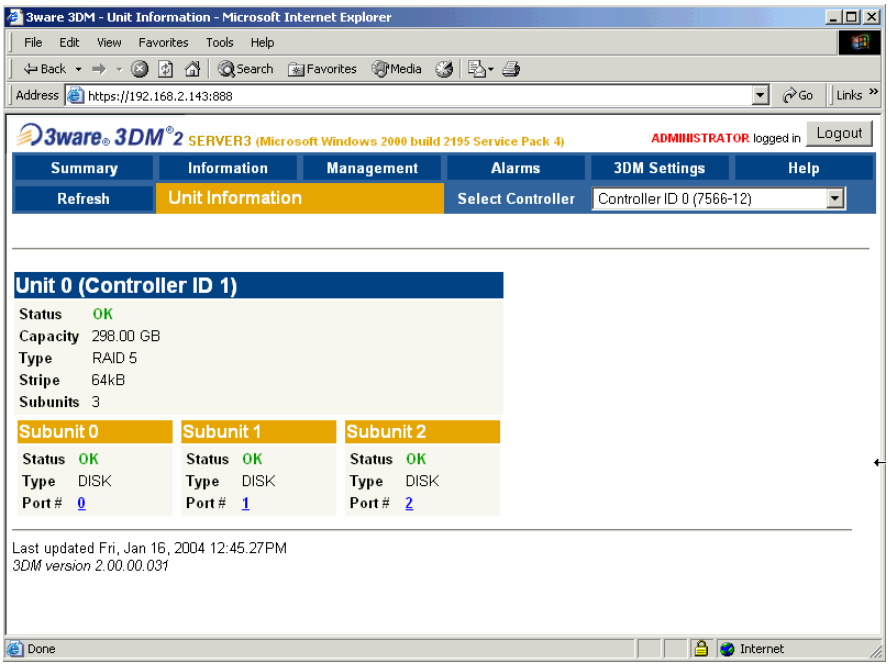

Figure 18. Unit Details Page

The Unit Details page appears when you click an ID number on the Unit Information page. Because it is a sub-page of Unit Information, the page title in the menu bar continues to display “Unit Information” even when you view details of a unit. To return to the list of units, click **Unit Information** in the menu bar.

The Unit Details page shows details about a particular unit. The specific information shown depends on what type of unit it is. For example, details about a RAID 10 unit made up of two subunits, each of which contains two drives, will include details about the unit and each subunit, as shown in

Figure 18. However, if the unit was a Single Disk, only information about one disk would be shown.

Details on this page may include all or some of the following information described below.

To see details about a particular drive, click the Port #. You'll see a list of all drives, with the drive you selected highlighted.

Status. The operational status of the unit or subunit: OK, Rebuilding, Initializing, Verifying, Degraded, or Inoperable (missing drives). When a unit is Rebuilding, Initializing, or Verifying, the percentage (%) complete is also shown.

Capacity. The total capacity of the unit (capacities of subunits are not shown).

Type. The type of unit or subunit it is. RAID 0, RAID 1, RAID 5, RAID 10, RAID 50, Single Disk, Spare, JBOD, or Disk

Stripe. The stripe size of the unit, if applicable.

Subunits. If the unit has subunits, details of the subunits are shown.

Port #. If the Type is Disk, Single Disk, JBOD, or Spare, the port to which the drive is connected is shown. For multiple drive units, the port numbers are shown in the subunits section. The port number is a link to the Drive Information page.

Drive Information Page

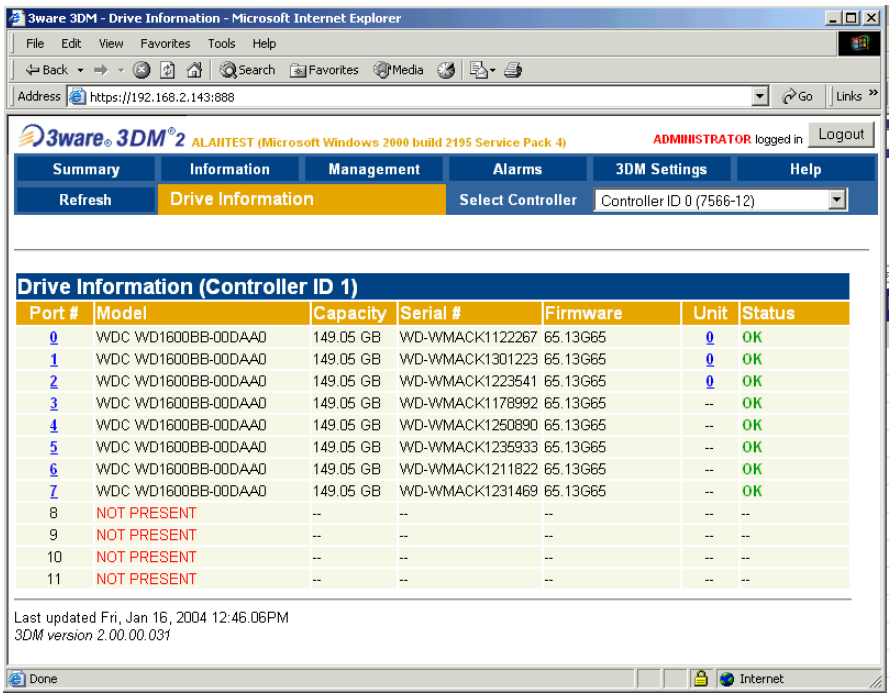
3ware 3DM - Drive Information - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address https://192.168.2.143:888
3ware 3DM 2 ALAINTEST (Microsoft Windows 2000 build 2195 Service Pack 4)
ADMINISTRATOR logged in
Logout
Summary
Information
Management
Alarms
3DM Settings
Help
Refresh
Drive Information
Select Controller
Controller ID 0 (7566-12)
Drive Information (Controller ID 1)
Port # Model Capacity Serial # Firmware Unit Status
0 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1122267 65.13G65 0 OK
1 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1301223 65.13G65 0 OK
2 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1223541 65.13G65 0 OK
3 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1178992 65.13G65 -- OK
4 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1250890 65.13G65 -- OK
5 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1235933 65.13G65 -- OK
6 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1211822 65.13G65 -- OK
7 WDC WD1600BB-00DAA0 149.05 GB WD-WMACK1231469 65.13G65 -- OK
8 NOT PRESENT
9 NOT PRESENT
10 NOT PRESENT
11 NOT PRESENT
Last updated Fri, Jan 16, 2004 12:46:06PM
3DM version 2.00.00.031
Done
Internet

Figure 19. Drive Information Page

The Drive Information page appears when you choose **Information > Drive Information** from the menu bar, or when you click a port # on the Unit Details page. If you arrive at this page from the port # hyperlink on the Unit Information page, the line showing the port # you clicked on is highlighted.

The Drive Information page shows a list of drives on the controller specified in the drop-down list on the menu bar, and a summary of each one.

To see the SMART data for a drive, click the link in the Port # column.

Port #. The port to which the drive is connected.

Model. The model of the drive.

Capacity. The physical capacity of the drive. (Note that the capacity as shown on 3DM screen is calculated as 1KB = 1024. This amount may differ from the capacity that is printed on the disk drive, where it typically has been calculated as 1K = 1000. Consequently, the capacity of the drive may appear smaller in the 3DM screens. No storage capacity is actually lost; the size has simply been calculated differently for consistency.

Serial #. The serial number of the drive.

Firmware. The firmware version of the drive.

Unit. The unit the drive belongs to, if applicable.

Status. The status of the drive: OK, Not Supported, Read Timeout, Read Failure, Orphan, DCB Data Check, Unsupp DCB, Unconv DCB, Offline JBOD, or Not Present. (In the event of a problem, the status shown for the drive can be useful to customer support.)

Note: In most cases, the status of the drive will not correspond to the status of the unit, shown on the Unit Information page.

SMART Details About Drive at Particular Port Page

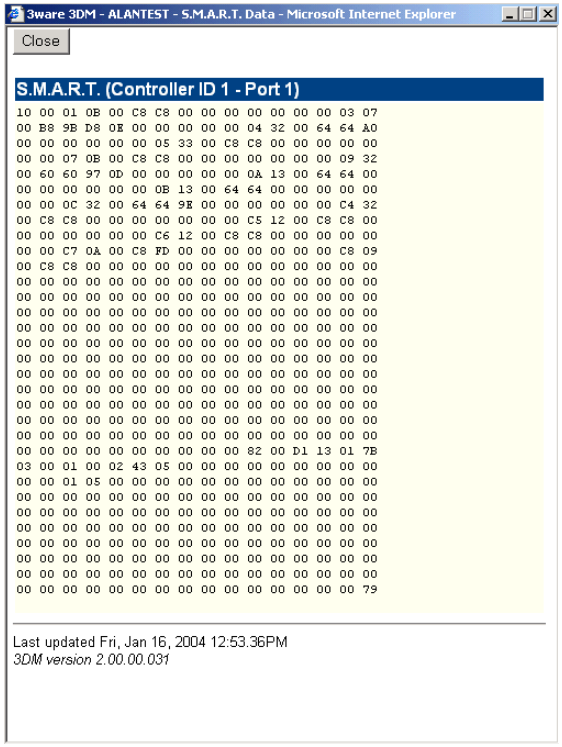

Figure 20. S.M.A.R.T Data Page

The SMART Details page appears when you click a Port # on the Drive Information page.

SMART data is displayed as hex values.

Consult your disk drive manufacturer for information on how to interpret the SMART data. The SMART data meaning varies by disk drive manufacturer and model.

Controller Settings Page

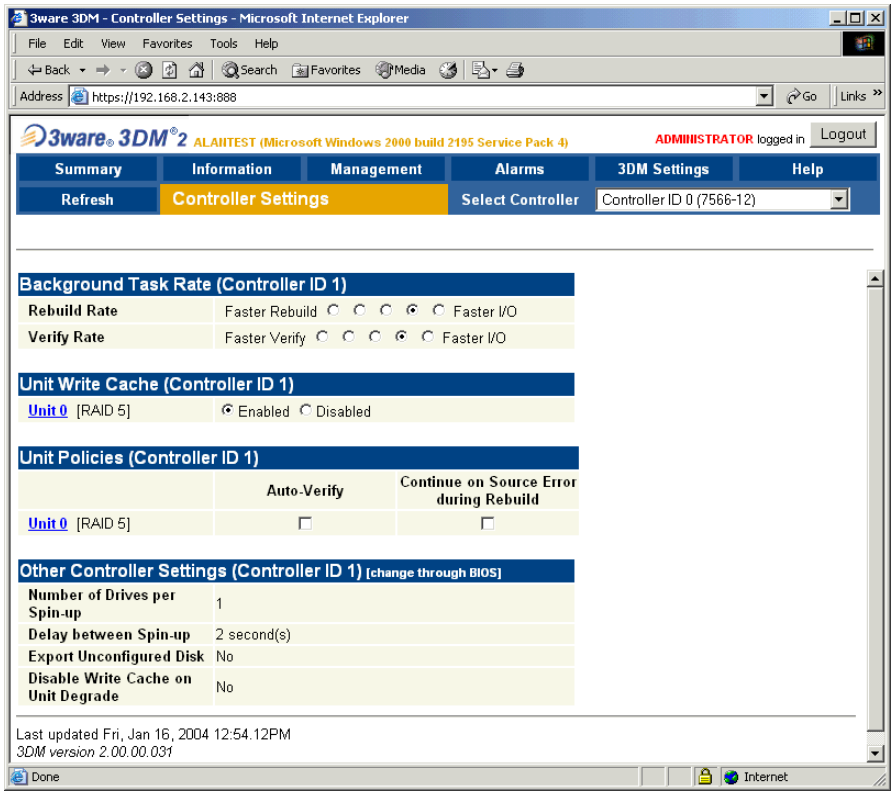

Figure 21. Controller Settings Page

The Controller Settings page appears when you choose **Management > Controller Settings** from the menu bar.

The Controller Settings page lets you view and change settings that affect the units on the controller specified in the drop-down list on the menu bar.

Background Task Rate

The Background Task Rate fields let you change the balance of background tasks (rebuild and verify) and I/O performed by the controller.

9000-series controllers show separate settings for Rebuild Rate and Verify Rate, as shown in Figure 21. 7000- and 8000-series controllers show only one setting for Task Rate; it applies to both rebuild and verify rates.This rate is not persistent following a reboot for 7/8000.

The 5 radio buttons let you set the ratio at which rebuilds and verifies are performed. The furthest left buttons set the firmware to the fastest rebuild and verify settings. This means, maximum processing time will be given to rebuilds or verifies rather than I/O. The furthest right buttons set the firmware to the slowest rebuild and verify settings, giving maximum processing time to I/O.

For additional information, see“Setting Background Task Rate” on page 113.

Unit Write Cache

You can enable or disable write cache for each unit.3DM lists each unit on the controller specified in the drop-down list on the menu bar, and shows you whether the write cache is currently enabled or disabled for it.

Write cache is a combination of the physical hard drives’ write cache as well as the controller’s memory, depending on what type of unit you are using.

For 9000-series controllers, a **Disable Write Cache on Unit Degrade** setting can be set in 3ware BIOS Manager (3BM). You can see if this setting is enabled in the **Other Controller Settings** field at the bottom of this Controller Settings page. If **Disable Write Cache on Unit Degrade** is enabled, upon degrade of a unit, the write cache will automatically be disabled, even if you enable write cache in the Unit Write Cache field.

For additional information, see “Enabling and Disabling the Unit Write Cache” on page 89.

Unit Policies

For units on 9000-series controllers, you can enable or disable two policies: **Auto-verify** and **Continue on Source Error During Rebuild**. 3DM lists each unit on the controller specified in the drop-down list on the menu bar, and shows you whether the policies are currently enabled or disabled for each unit.

This section does not appear for 7000- and 8000- series controllers.

Auto-verify. The Auto-verify policy causes verify tasks to be performed repeatedly during a scheduled verify window. When Auto-verify is disabled, verify is not initiated automatically by the controller. Verify can still be started manually with 3DM, 3BM, or CLI. Once a manually-started verification is complete, no further verify tasks for the unit is performed.

Continue on Source Error During Rebuild. This policy applies only to units which are redundant. (For units which are not redundant, a check box is not available.) When this policy is set, ECC errors are ignored when they are encountered during a rebuild. When this policy is not set, a rebuild will abort upon encountering an ECC error and the unit will be set back to Degraded.

Since this option could result in the loss of some source data in the event of source errors, select this option only if you want to ensure that a rebuild will complete successfully without manually intervention. If the rebuild fails and **Continue on Source Error During Rebuild** is not selected, then you have the option to start a rebuild manually. It is recommended that a file system check be executed when the rebuild completes.

Note: The policy **Continue on Source Error During Rebuild** is equivalent to the "Force continue on source errors" option in 3DM v 1.x and the "ignoreEcc" option in the CLI.

Other Controller Settings

For 9000-series controllers, the Other Controller settings displays information about additional settings that can only be changed in the BIOS (3BM). For more information see "Setting Policies for a Controller through 3BM" on page 74.

This section does not appear for 7000- and 8000- series controllers.

Number of Drives Per Spin-up. Number of drives that will spin up at the same time when the controller is powered up. (This setting only applies when the feature is supported by the disk drives and has been enabled in 3BM.)

Delay between Spin-ups. The delay between drive groups that spin up at one time on this particular controller.

Export JBOD (Unconfigured) Disks. Indicates whether unconfigured disks (JBODs) should be exported to the operating system. By default, this setting is disabled. For more information about this feature, see "Exporting JBOD Disks" on page 75.

Disable Write Cache on Unit Degrade. Indicates whether write cache will be automatically disabled on a unit if it becomes degraded. After the unit is rebuilt, the write cache will be re-enabled automatically.

Scheduling Page

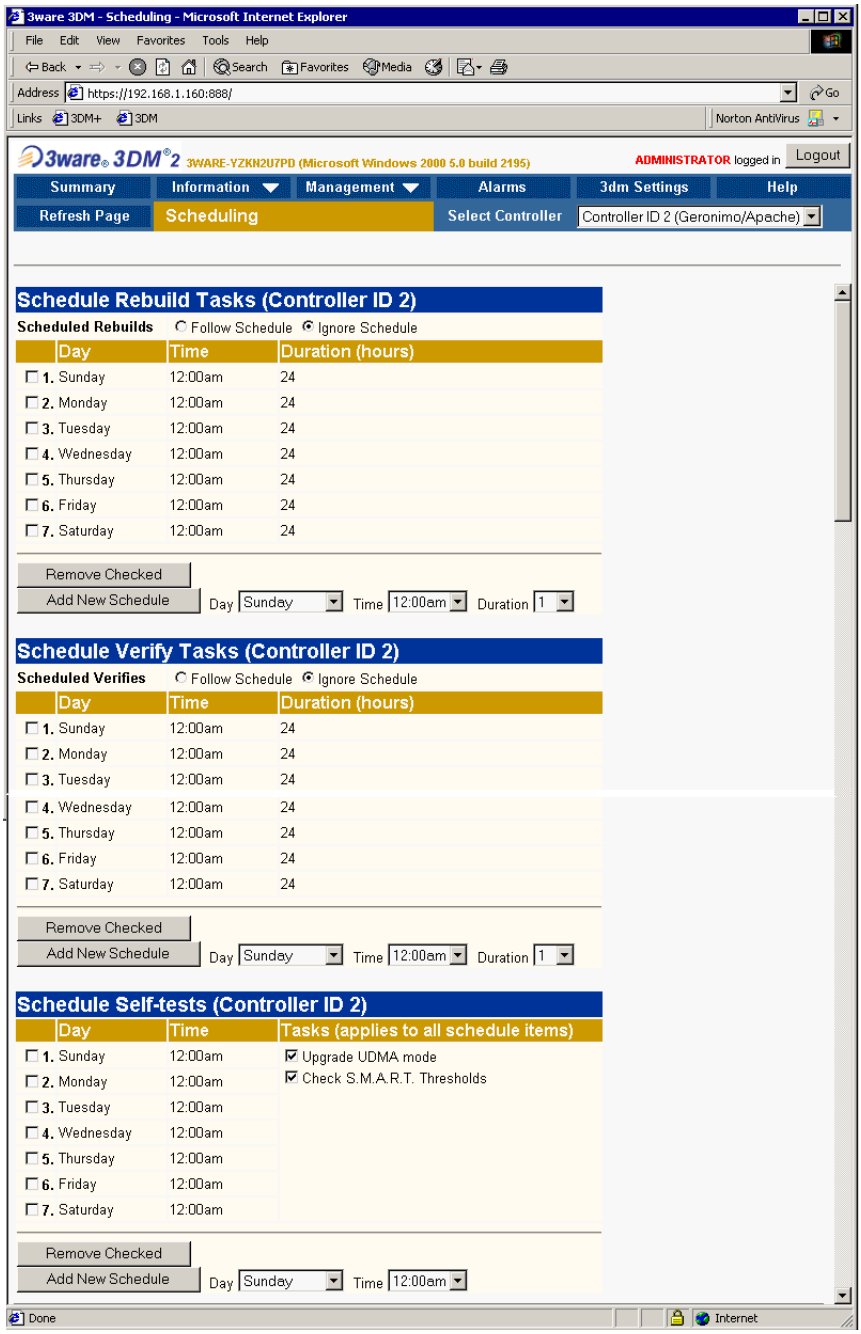

Figure 22. Scheduling Page

For 9000-series controllers, the Scheduling page appears when you choose **Management > Scheduling** from the menu bar.

The Scheduling page is not available for 7000- and 8000- series controllers. If you want to schedule tasks for one of those controllers, use 3DM Version 1.x.

The Scheduling page lets you view and change the schedule for tasks that affect all units on the controller specified in the drop-down list on the menu bar, including:

- Rebuild tasks (also applies to initialization tasks)
- Verify tasks (also applies to media scans)
- Self-tests

You can also enable or disable use of the schedule for Rebuild and Verify tasks by selecting either **Follow Schedule** or **Ignore Schedule**. When these schedules are set to be ignored, these tasks can be performed at any time, and are not restricted to the scheduled times.

Note: Scheduling of these tasks is only available on the 9000-series controllers.

For details about the different background tasks, see "About Background Tasks" on page 109.

About Task Schedules

Each type of task may be scheduled for up to 7 times per week. This limits active initializing, rebuilding, verifying, and testing of a unit to the times you specify, so that the task does not interfere with peak I/O times.

If all 7 schedule slots are filled, you must first remove one or more schedule times before you can add another.

You may set schedule times whether scheduling is set to be followed or ignored. This is useful if you want to temporarily disable the schedule.

If you remove all the schedule times for a particular background task, initializations and rebuilds will run anytime, as they are needed. Verify will only run if started by the CLI or if the Verify Unit button is clicked.

For information about adding and removing schedules, and setting schedules to be followed or ignored, see "Scheduling Background Tasks" on page 114

About Self-tests

Unlike scheduling of rebuilds and verifies, scheduling of self-tests is always followed. To disable self-tests you either remove all schedule times, or uncheck the tests listed in the Tasks column.

Note: Only the checked tasks will be run during the scheduled times. If none of the tasks are checked, self-tests will never run, even if you have scheduled time slots set.

Two self-tests can be scheduled:

Upgrade UDMA mode. This test checks the speed at which data transfer to drives is occurring, to see if the UDMA mode can be increased. (If you are already running at the fastest UDMA mode, then this self-test has no effect.)

The UDMA mode can become downgraded in the event that cable CRC errors are encountered, requiring multiple retries to read sectors. In severe cases, the UDMA mode may be downgraded from ATA 150 to ATA 133, to ATA 100, to 66, to 33.

This check is also done every time the system is booted.

UDMA mode does not apply to SATA.

Check SMART Thresholds. This test checks to see whether SMART thresholds have been exceeded.

The SMART thresholds indicate when a drive is likely to fail, based on the number of errors that have been recorded through SMART (Self-Monitoring, Analysis and Reporting Technology).

If any of the disk drives have detected a “threshold exceeded” condition, then an AEN is logged to the 3DM Alarms page. Moreover, if anything unusual is found during any self-test, it will be logged as an Alarm.

Maintenance Page

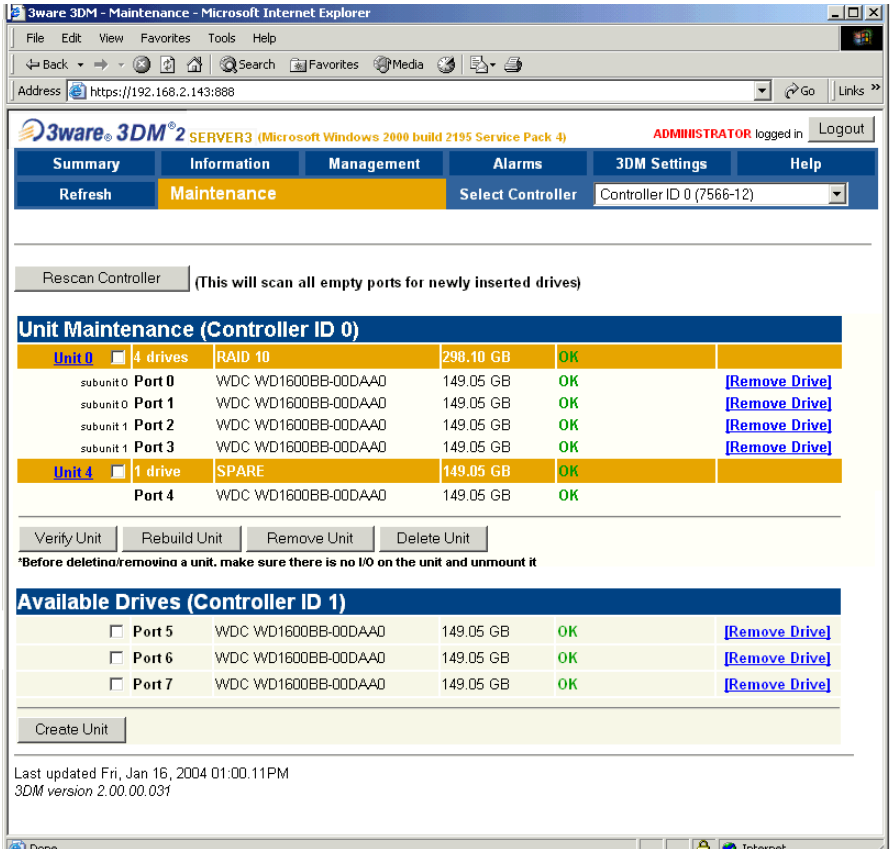
3ware 3DM - Maintenance - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address https://192.168.2.143:888
3ware 3DM 2 SERVER3 (Microsoft Windows 2000 build 2195 Service Pack 4)
ADMINISTRATOR logged in
Logout
Summary
Information
Management
Alarms
3DM Settings
Help
Refresh
Maintenance
Select Controller
Controller ID 0 (7566-12)
Rescan Controller
(This will scan all empty ports for newly inserted drives)
Unit Maintenance (Controller ID 0)
Unit 0
4 drives
RAID 10
298.10 GB
OK
subunit 0 Port 0 WDC WD1600BB-00DAA0 149.05 GB OK [Remove Drive]
subunit 0 Port 1 WDC WD1600BB-00DAA0 149.05 GB OK [Remove Drive]
subunit 1 Port 2 WDC WD1600BB-00DAA0 149.05 GB OK [Remove Drive]
subunit 1 Port 3 WDC WD1600BB-00DAA0 149.05 GB OK [Remove Drive]
Unit 4
1 drive
SPARE
149.05 GB
OK
Port 4 WDC WD1600BB-00DAA0 149.05 GB OK
Verify Unit
Rebuild Unit
Remove Unit
Delete Unit
*Before deleting/removing a unit, make sure there is no I/O on the unit and unmount it
Available Drives (Controller ID 1)
Port 5 WDC WD1600BB-00DAA0 149.05 GB OK [Remove Drive]
Port 6 WDC WD1600BB-00DAA0 149.05 GB OK [Remove Drive]
Port 7 WDC WD1600BB-00DAA0 149.05 GB OK [Remove Drive]
Create Unit
Last updated Fri, Jan 16, 2004 01:00.11PM
3DM version 2.00.00.031

Figure 23. Maintenance Page

The Maintenance page appears when you choose **Management > Maintenance** from the menu bar.

The Maintenance page lets you perform maintenance tasks on existing units on the current controller (shown in the drop-down list on the menu bar), and lets you create new units by configuring available drives.

Rescan Controller

Use the **Rescan Controller** button to have 3DM scan the available drives in the controller and update the list of available drives shown. This is useful in variety of maintenance tasks. For example, if you physically plug in a drive and want the controller to recognize the newly plugged in drive.

Note: If you unplug a drive without first removing it through 3DM, Rescan will not recognize it as gone unless the drive was in use or until it is required by the system. Always use the **Remove** link to remove a drive before unplugging it.

Warning: Removing or adding drives which are not in hotswap carriers can result in a system hang or may even damage the system and the drive.

In 9000-series controllers, rescan checks empty ports for newly plugged in drives. If those drives were previously part of a 3ware RAID configuration and they still have valid DCB (Disk Configuration Block) information on them, the controller tries to piece them back together into a working unit. If a working unit can be formed, it will appear in the Unit Maintenance list when the scan is complete, and the operating system will be notified of the unit. In Linux or FreeBSD, a device node will be associated with each unit created. In Windows the device manager will reflect the changes under the disk drives icon. This process is known as importing drives.

If new drives do not have any data indicating they were previously part of a 3ware RAID configuration, they will appear in the Available Drives list.

In addition, if there is a unit with the status Inoperable before a rescan (for example, a RAID 5 unit missing 2 or more drives), and a rescan finds drives that complete the unit, the inoperable unit will become a valid unit.

Note: In 8000-series controllers, only JBOD units can be removed and rescanned while keeping the data intact. Clicking **Rescan Controller** after removing units other than a JBOD unit (e.g. RAID 5) will cause the drives that make up the unit to be seen as individual available drives; they will not be pieced together to form a unit. This is unlike the 9000 series controllers, which will piece together the unit for you and display the drives as a unit. If you still want to use the drives together as a unit, restart the computer before creating a new unit with those drives. Creating a new unit with those drives will destroy any existing data on them. After you restart, the 8000 will again see the drives as a valid unit.

Unit Maintenance

The Unit Maintenance section of the page lists all existing units on the current controller, and displays summary information about them.

The top row shows information about the unit, while subsequent rows show summary information about each drive in the unit.

Unit Information

Unit Number. The unit number assigned to the unit by the firmware. Unit numbers for 9000 series are in sequential order. Unit numbers for the 7/8000 series will begin with the lowest port number of the unit. Use the checkbox next to the unit to select a unit before clicking one of the task buttons.

 # Drives. Number of drives in the unit.

Type of Unit. Type of unit specified during configuration: RAID 0, RAID 1, RAID 5, RAID 10, RAID 50, Single Disk, Spare, or JBOD.

Capacity. The usable capacity (size) of the unit.

Status. Operational status of the unit: Ok, Rebuilding, Initializing, Verifying, Degraded, or Inoperable (missing drives). When Rebuilding, Initializing, or Verifying, the percentage (%) complete is also shown. The % complete can be active or paused. To see whether this task is currently active or paused, click on the unit number to display the Unit Information page, which has that information.

Drive Information

Port. The port to which the drive is connected.

Model. The model of the drive.

Capacity. The capacity (size) of the drive.

Status. The status of the drive: OK, Not Supported, Not Present, and so forth. If you need help regarding a status displayed here, please contact Technical Support.

Remove Drive. The **Remove Drive** link removes a drive from the controller so that you can safely unplug it. In the Unit Maintenance section, this link is only provided for drives that can be safely removed without creating an inoperable unit. (For example, a RAID 5 missing 2 or more drives or a RAID 0 missing 1 or more drives would become inoperable.) If you remove a drive from a redundant unit, the unit will become degraded. Once a unit has become degraded, additional drives cannot be removed without making it inoperable, so no **Remove Drive** link will display.

Warning: Physically removing drives which are not in hotswap carriers can result in a system hang or may even damage the system and the drive.

Maintenance Task Buttons

Below the list of units, a row of task buttons lets you preform maintenance and configuration tasks related to the unit. Before clicking one of these buttons, select the appropriate unit.

Verify Unit. Puts the selected unit in verifying mode. If verify scheduling is enabled on the Scheduling page, the unit will not start actively verifying until the scheduled time, and the status will indicate “Verify-Paused.” (The Unit Details page will indicate whether a unit is actively verifying.) If verify scheduling is not enabled, clicking **Verify Unit** begins the verification process.

If the unit you selected to verify is a redundant unit, the redundancy of the unit will be verified. For example it will check parity for a RAID 5 or check data consistency for a RAID 1. If the unit you checked is not a redundant unit, verify will do a surface scan of the media. During verification, I/O continues normally. For RAID 0, single disks, JBODs, and spares, there is only a slight performance loss. For redundant units, you can set the background task rate on the Controller Settings page to specify whether more processing time should be given to verifying or to I/O.

While a unit is verifying, the status changes to Verifying and a **Stop Verify** link appears in the right-most column of the Unit Maintenance table.

Note: If the unit has not previously been initialized and you click **Verify Unit**, the initialization process starts. Initialization cannot be halted, so no Stop Verify link appears. (Initialization can be paused, however, through Scheduling. Initialization follows the Rebuild schedule, so turning on scheduling for Rebuild will pause initialization, as well.) For more information about initialization, see “About Initialization” on page 109.

Rebuild Unit. Replaces a degraded drive in a degraded unit with an available drive and begins rebuilding the RAID. When you select a degraded unit and click **Rebuild Unit**, a dialog box listing available drives appears, so that you can select the drive you want to use. If the degraded unit has more than one degraded drives (for example, a RAID 10 where both mirrored pairs each have a degraded drive), you will repeat this process a second time.

If rebuild scheduling is enabled on the Scheduling page, the unit will not start actively rebuilding until the scheduled time, and the status will change to say “Rebuild-Paused.” (The Unit Details page indicates whether a unit is actively rebuilding.) If rebuild scheduling is not enabled, the rebuild process will begin right away.

Remove Unit. Removes a selected unit and allows you to unplug the drives and move the unit to another controller. the data on the unit remain intact.

Caution: Before you click **Remove Unit**, make sure the unit you are removing is unmounted and no I/Os are being issued. (For example, make sure you are not copying files to the unit, and make sure that there are no applications with open files on that unit.)

If a unit is not unmounted and you remove it, it is the equivalent of physically yanking a hard drive out from under the operating system. Resulting behavior depends on which operating system you are using and what kind of I/O is being done, however you will typically see really bad results, bad errors, and most likely a reset of the controller or a system hang.

To unmount a unit under windows, use Administrative Tools > Computer Management > Disk Management. In the Computer Management window, right-click on the partition and Remove the logical drive letter associated with the unit.

To unmount a unit under Linux, unmount the mount point to where the RAID unit is mounted. For example, if you want to remove unit 0 and you know that 0 corresponds to /dev/sdb, you should unmount all partitions for sdbx (where x is the number of the partition).

```
umount /dev/sdbx
```

For FreeBSD, the command would be

```
umount /dev/twedx
```

When you click **Remove Unit**, you will be asked to confirm that you want to proceed. When you confirm the removal, the unit number and information will be removed from 3DM. (Units created in the future can reclaim this unit number.)

The operating system is notified that the unit was removed. In Linux the device node associated with this unit is removed. In Windows the Device Manager will reflect the changes under the disk drives icon.

Information about the unit remains intact on the drives. This allows the drive or drives to be reassembled into a unit again on this controller, or if moved to another controller.

Warning: Physically removing drives which are not in hotswap carriers can result in a system hang or may even damage the system and the drive.

Delete Unit. Deletes the selected unit and allows you to use the drives to create another unit. The drives appear in the list of Available Drives.

Caution: Before you click **Delete Unit**, make sure the unit you are removing is unmounted and no I/Os are being issued. If a unit is not unmounted and you delete it, it is the equivalent of physically yanking a hard drive out from under the operating system. Resulting behavior depends on which operating system you are using and what kind of I/O is being done, however you will typically see really bad results, bad errors, and most likely a reset of the controller or a system hang.

Devices can be unmounted through the operating system. For details, see the discussion under **Remove Unit**, above.

Warning: When a unit is deleted, the data will be permanently deleted: the drives cannot be reassembled into the same unit. If you want to reassemble the drives on another controller and access the existing data, use **Remove Unit** instead of **Delete Unit**.

After deletion, the operating system is notified that the unit was deleted. In Linux the device node associated with this unit is removed. In Windows the Device Manager will reflect the changes under the disk drives icon.

Available Drives (to Create Units)

This section lists the drives on the controller which are not currently configured as part of a unit. The Port number, model, capacity, and status are all displayed, as they are for drives in existing units.

Remove Drive. The Remove Drive link removes a drive from the controller so that you can safely unplug it. Any drive in the Available Drives list can be removed.

Warning: Physically removing drives which are not in hotswap carriers can result in a system hang or may even damage the system and the drive.

Create Unit

Use the **Create Unit** button to create a unit for use on the current controller. Begin by selecting the drives you want to use in the list of Available Drives, and then click **Create Unit**. You will be prompted to select the unit Type, Stripe size (if applicable), Write Cache, and Auto Verify settings.

A window like the one in Figure 24 shows the drives you selected, and lets you specify configuration settings.

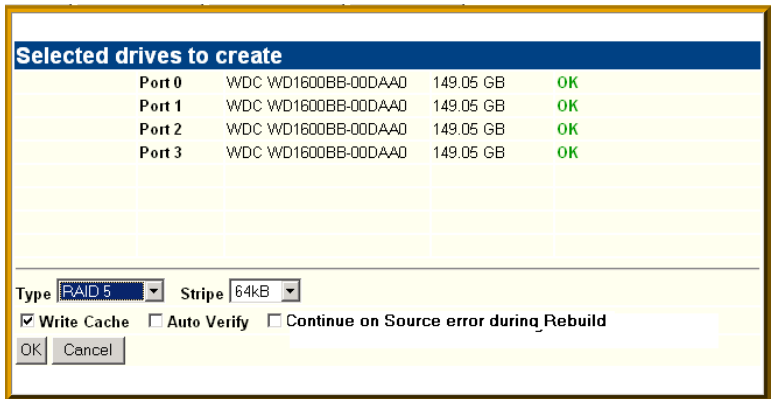
Selected drives to create
Port 0 WDC WD1600BB-00DAA0 149.05 GB OK
Port 1 WDC WD1600BB-00DAA0 149.05 GB OK
Port 2 WDC WD1600BB-00DAA0 149.05 GB OK
Port 3 WDC WD1600BB-00DAA0 149.05 GB OK
Type RAID 5 Stripe 64kB
Write Cache Auto Verify Continue on Source error during Rebuild
OK Cancel

Figure 24. Configuring a Unit in 3DM

For more detailed instructions, see “Creating a Unit through 3DM” on page 82.

Type. The drop-down list lists the possible RAID configurations for the drives selected in the list of Available Drives. Available configurations may include RAID 0, RAID 1, RAID 5, RAID 10, RAID 50, Single Disk, and Spare Disk. For information about these configurations, see “Available RAID Configurations” on page 9.

When you are configuring a RAID 50 with twelve drives, an additional field appears, in which you select the number of drives per subunit—3, 4, or 6.

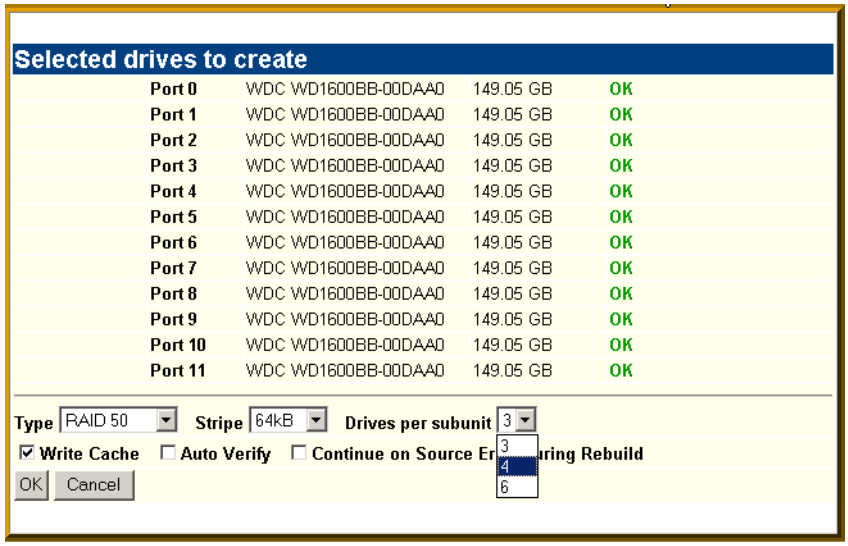
Selected drives to create
Port 0 WDC WD1600BB-00DAA0 149.05 GB OK
Port 1 WDC WD1600BB-00DAA0 149.05 GB OK
Port 2 WDC WD1600BB-00DAA0 149.05 GB OK
Port 3 WDC WD1600BB-00DAA0 149.05 GB OK
Port 4 WDC WD1600BB-00DAA0 149.05 GB OK
Port 5 WDC WD1600BB-00DAA0 149.05 GB OK
Port 6 WDC WD1600BB-00DAA0 149.05 GB OK
Port 7 WDC WD1600BB-00DAA0 149.05 GB OK
Port 8 WDC WD1600BB-00DAA0 149.05 GB OK
Port 9 WDC WD1600BB-00DAA0 149.05 GB OK
Port 10 WDC WD1600BB-00DAA0 149.05 GB OK
Port 11 WDC WD1600BB-00DAA0 149.05 GB OK
Type RAID 50 Stripe 64kB Drives per subunit 3
3
4
6
Write Cache Auto Verify
ring Rebuild
OK Cancel

Figure 25. Configuring a RAID 50 with 12 Drives

Stripe. The drop-down list of stripe sizes lists the possible stripe sizes for the configuration you selected in the RAID level drop-down.

The default stripe size of 64KB will give the best performance with applications that have many sequential reads and writes. A larger stripe size will give better performance with applications that have a lot of random reads

and writes. In general, the smaller the stripe size, the better the sequential I/O and the worse the random I/O. The larger the stripe size, the worse the sequential I/O and the better the random I/O.

Write Cache, Auto-Verify, and Continue on Source Error during Rebuild. These check boxes let you set the policies for the unit. These policies can also be set and changed on the Controller Settings page. For details about these policies, see "Unit Policies" on page 54.

Note: If the configuration window disappears while you are selecting drives, 3DM 2 may have refreshed. Click **Create Unit** again. If desired, you can reduce the frequency with which information refreshes in 3DM 2, or disable refresh temporarily, on the 3DM Settings page.

Alarms Page

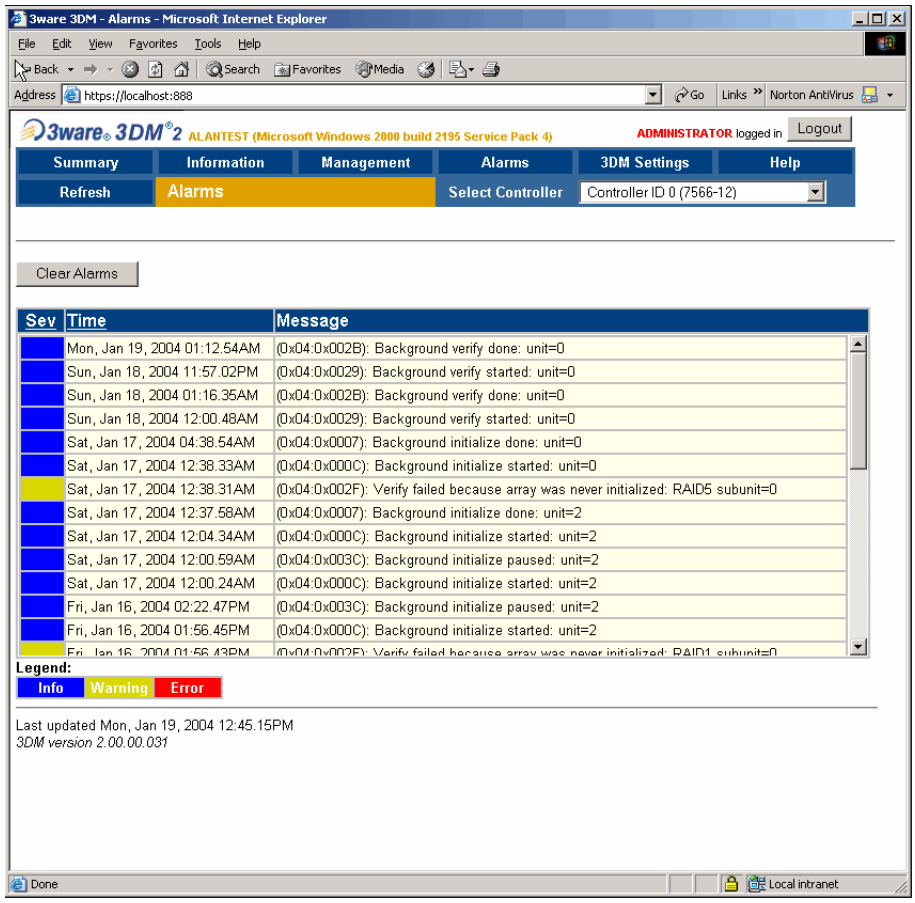
3ware 3DM - Alarms - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address https://localhost:888
Go Links Norton AntiVirus
3ware 3DM 2 ALANTEST (Microsoft Windows 2000 build 2195 Service Pack 4)
ADMINISTRATOR logged in Logout
Summary Information Management Alarms 3DM Settings Help
Refresh Alarms Select Controller Controller ID 0 (7566-12)
Clear Alarms
Sev Time Message
Mon, Jan 19, 2004 01:12.54AM (0x04:0x002B): Background verify done: unit=0
Sun, Jan 18, 2004 11:57.02PM (0x04:0x0029): Background verify started: unit=0
Sun, Jan 18, 2004 01:16.35AM (0x04:0x002B): Background verify done: unit=0
Sun, Jan 18, 2004 12:00.48AM (0x04:0x0029): Background verify started: unit=0
Sat, Jan 17, 2004 04:38.54AM (0x04:0x0007): Background initialize done: unit=0
Sat, Jan 17, 2004 12:38.33AM (0x04:0x000C): Background initialize started: unit=0
Sat, Jan 17, 2004 12:38.31AM (0x04:0x002F): Verify failed because array was never initialized: RAID5 subunit=0
Sat, Jan 17, 2004 12:37.58AM (0x04:0x0007): Background initialize done: unit=2
Sat, Jan 17, 2004 12:04.34AM (0x04:0x000C): Background initialize started: unit=2
Sat, Jan 17, 2004 12:00.59AM (0x04:0x003C): Background initialize paused: unit=2
Sat, Jan 17, 2004 12:00.24AM (0x04:0x000C): Background initialize started: unit=2
Fri, Jan 16, 2004 02:22.47PM (0x04:0x003C): Background initialize paused: unit=2
Fri, Jan 16, 2004 01:56.45PM (0x04:0x000C): Background initialize started: unit=2
Legend:
Info Warning Error
Last updated Mon, Jan 19, 2004 12:45.15PM
3DM version 2.00.00.031
Done
Local intranet

Figure 26. Alarms Page

The Alarms page appears when you click **Alarms** on the menu bar.

This page displays a list of AENs (asynchronous event notifications) received from the controller displayed in the drop-down list in the menu bar.

Up to 1000 alarms can be listed. After the 1000-limit is reached, the oldest alarms are deleted, as new ones occur.

You can sort the alarms by severity or time. To do so, just click the column header.

For 8000 and 9000-series controllers, alarms can be used by either 3DM or CLI, but not both. Whichever issues an alarms command first determines which can see alarm data.

Clear Alarms. The **Clear Alarms** button removes all alarms shown in the list.

Sev. Shows the severity of the event. Three levels are provided:

- Errors are shown next to a red box
- Warnings are shown next to a yellow box
- Information is shown next to a blue box

Time. The time shown for alarms generated by 7000- and 8000- series controllers is the time retrieved from the driver by 3DM. The time shown for alarms generated by 9000-series controllers is the time received by the driver from firmware.

Message. The specific text relating to the alarm condition.

3DM Settings Page

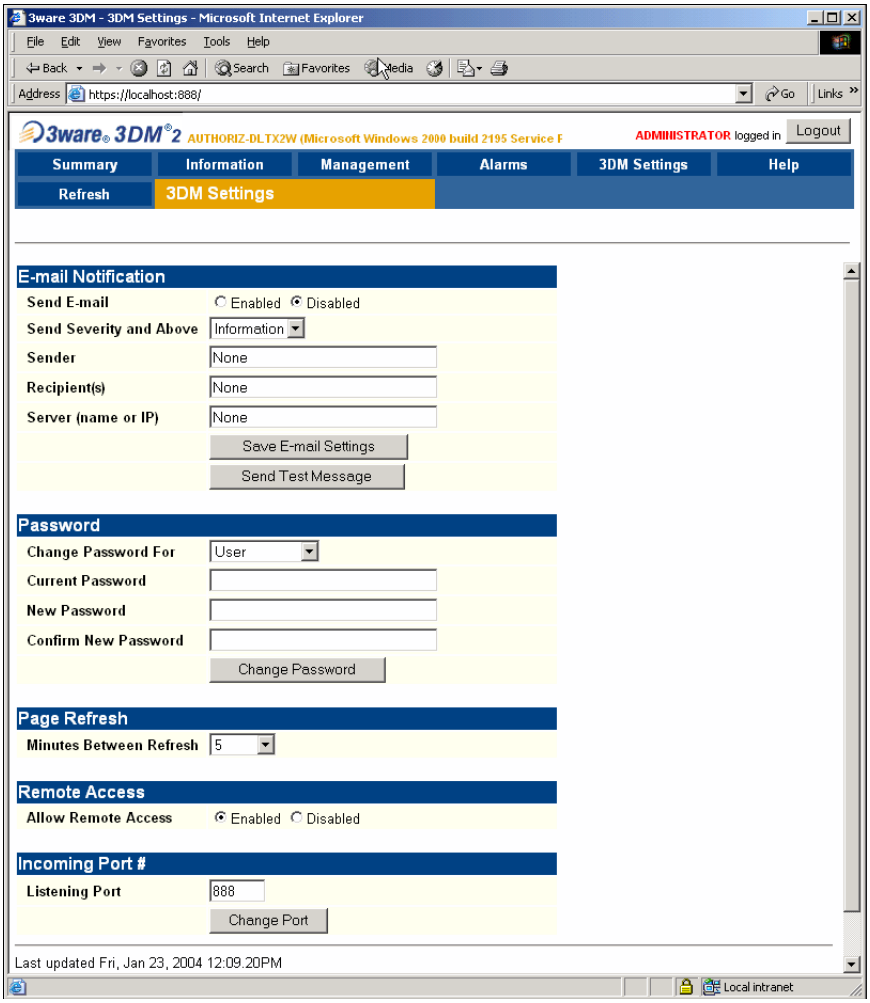

Figure 27. 3DM Settings Page

The 3DM Settings page appears when you click **3DM Settings** on the menu bar. Use this page to set preferences, including email notification for alarms, passwords, page refresh frequency, whether remote access is permitted, and the incoming port for 3DM to listen for requests.

The initial settings for most of these preferences are specified during installation of 3DM.

E-mail Notification

Use the fields in this section to set up and manage notifications of events by e-mail.

Send E-mail. This field determines whether e-mail notification is **Enabled** or **Disabled**.

Send Severity and Above. Specifies the type of events for which notifications should be sent. A severity of **Information** will send e-mails for all alarms, a severity of **Warning** will send e-mail for alarms with severity of Warning and Error. A severity of **Error** will send e-mail for alarms with severity of Error.

Sender. Enter the email address which will appear in the "From" field.

Recipient. The e-mail address to which notifications should be sent. You can enter multiple addresses, separated by commas (,).

Server (name or IP). If the machine on which you are running 3DM has access to a nameserver, you may enter the machine name of the mail server in the Server field. Otherwise, use the IP address.

Save E-mail Settings button. Saves the e-mail notification settings.

Send Test Message button. Sends a test message using the saved e-mail settings.

Password

Use the fields in this section to set the passwords for the User and Administrator. When 3DM is first installed, the default password for both is `3ware`.

Change Password For. Select the access level for which you are setting the password: **User** or **Administrator**. Users can only view status information in 3DM, while Administrators can make changes and administer the controller and associated drives.

Current Password. Enter the current password.

New Password. Enter the new password.

Confirm New Password. Enter the new password a second time, to be sure you have entered it correctly.

Change Password button. Saves password changes.

Page Refresh

Minutes Between Refresh. Displays how frequently pages in 3DM will be refreshed with new data from the controller. To change this setting, select another option from the drop-down. If you prefer 3DM to only refresh when you click **Refresh Page**, select **Never**.

The Login, Help and Drive SMART data pages do not automatically refresh. All other 3DM pages do.

Remote Access

Allow Remote Connections. This field enables or disables the ability for users and administrators to access 3DM from a remote computer.

Incoming Port

Listening Port. This field specifies the HTTP: port to be used by 3DM when listening for communications. The default port setting is 888.

If you change this port, make sure the port you specify is not being used. Failure to do so will cause 3DM to stop responding and you will have to restart it by hand.

Change Port button. Saves a new port number.